

APR 13 1942

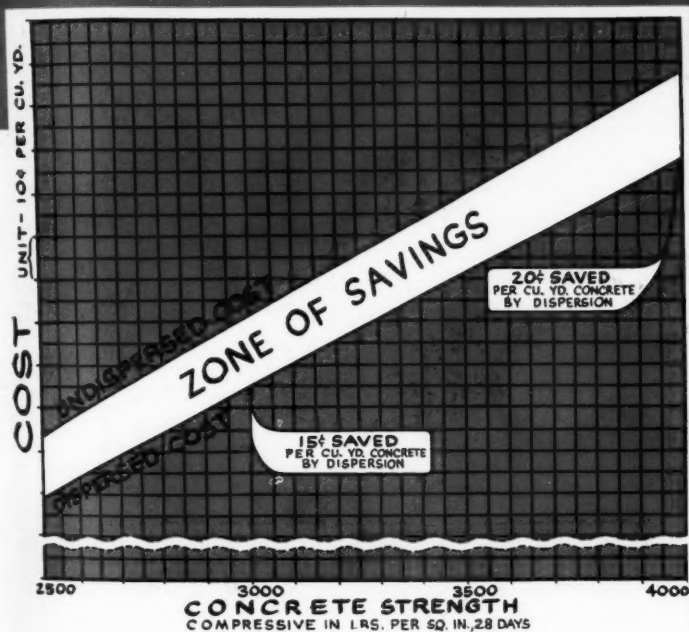
APRIL, 1942

# PUBLIC WORKS

Streets and Highways  
Sewage Disposal

Water Works  
Airports

## INCREASE CONCRETE DURABILITY AND CUT COSTS WITH CEMENT DISPERSION THROUGH THE USE OF POZZOLITH



Based on cement at 50c per sack.

Whatever Your Concrete Requirements are—whether they be for low strength or high strength, for a 5-year shed or a 50-year Dam—You Produce Them at Lower First Cost with concrete designed and built with Pozzolith. In addition, subsequent costs for Maintenance are lower.

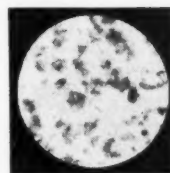
1. Concrete of Given Strength is produced at Lower Cost.
2. Stronger and More Durable Concrete is produced at a Given Cost.

### HOW CEMENT DISPERSION WORKS

Investigation shows that with 28 days curing only 50% of the cement hydrates. [Anderegg and Hubbell, A.S.T.M. 29 11 554 (1929)].

#### WITHOUT POZZOLITH

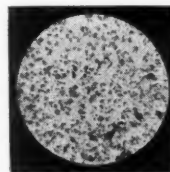
Cement particles in their normal state in water tend to gather in bunches; i.e., flocculate. Water never reaches some particles and many are only partly hydrated. This reduces the effectiveness of the cement, entraps water within the clumps, requires an excess of water for placement and often results in bleeding and segregation. See photomicrograph at right.



Cement suspended in water  
UNDISPERSED

#### WITH POZZOLITH

With Pozzolith the dispersion principle operates to drive each particle apart, thus exposing all the cement particles to the vital hydrating action. See photomicrograph at left.



Cement suspended in water  
DISPERSED

This dispersion makes the cement usable to its maximum efficiency since all the water is made available for lubrication of the mix and the entire surface area is exposed for hydration.

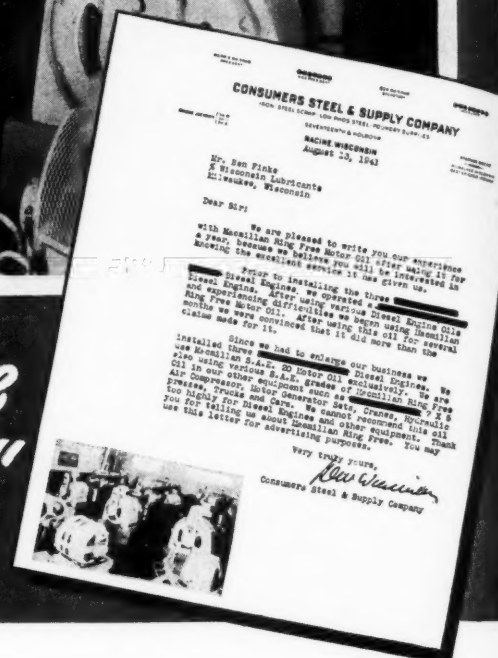
Send for Research Paper No. 36 "Economics of Cement Dispersion" and complete facts on Pozzolith.

THE MASTER BUILDERS COMPANY  
CLEVELAND, OHIO TORONTO, CANADA

# MASTER BUILDERS



*"...Did more than the claims made for it!"*



READ the experience of Consumers Steel & Supply Company of Racine, Wisconsin.

"After using various Diesel Engine Oils and experiencing difficulties," they say, "we began using Macmillan RING-FREE Motor Oil.

"After using this oil for several months we were convinced that it did more than the claims made for it."

With an enlarged business they are now "using Macmillan S.A.E. 20 Motor Oil exclusively."

The italics are ours, but the sentiments are theirs.

Various other weights of Macmillan RING-FREE are used in Consumers Steel's other equipment such as

AIR COMPRESSOR  
MOTOR GENERATOR SETS  
CRANES  
HYDRAULIC PRESSES  
TRUCKS AND CARS

If you, too, will concentrate on Macmillan RING-FREE, instead of using different oils with

indifferent results, you will find that what RING-FREE has done for others it can do for you.

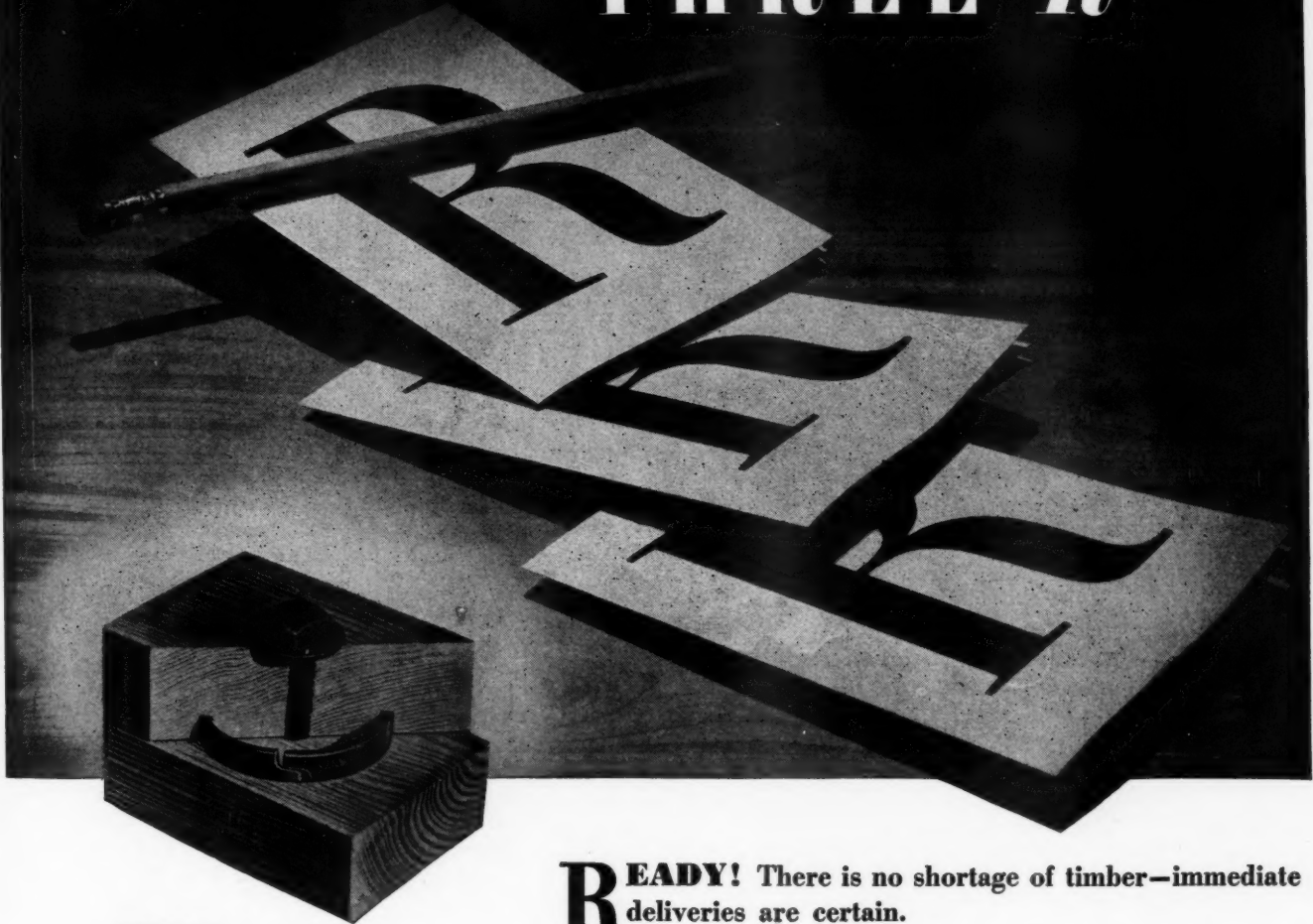
May we hear from you, describing your requirements?

MACMILLAN PETROLEUM CORPORATION  
50 West 50th Street, New York • 624 South Michigan Avenue, Chicago • 530 West 6th Street, Los Angeles



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# An Engineer's THREE R's



## **TECO** CONNECTORS

*spread the load on a timber joint more equally over the cross-section of the wood.*

## **Timber** ENGINEERING COMPANY

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*When writing, we will appreciate your mentioning PUBLIC WORKS*



# The Editor's Page

## Sewage Treatment Plant Design—and What Happens Afterward

Progress in sewage treatment has been so rapid that many of us forget certain fundamentals necessary for success. Today we design our treatment plants on a mathematical basis—for instance, so many pounds of B.O.D. per cubic yard of stone, or so many cubic feet of air per million pounds of B.O.D. in the sewage. An overload thus becomes serious, for it almost inevitably results in poor operating results. A parallel instance in the highway field is the assumed bridge loading for design. It was not economically feasible to construct bridges on county and town highways sufficiently strong to carry the heaviest truck-trailer loads that might be used by private enterprise; hence, weight regulation of vehicles using public roads is necessary.

The situation in regard to sewage treatment is closely analogous, but not so easily solved. Excessive use of water, increasing sewage flows far beyond design limits, must be restricted. It goes without saying that the designing engineer should survey the local situation and should provide for the correction of all defects that he finds which are likely to affect future sewage plant operation. Thereafter, it may be a problem for the State Board of Health, which should initiate corrective measures well in advance of necessity.

Not so many years ago, as suggested in our first sentence, this matter was not highly important. The old Imhoff tank didn't do much worse with a 100% overload than with normal load; the low-rate trickling filters merely operated at an accelerated pace; sand beds ran over in wet weather; and the stream into which the plant effluent discharged got really rich. Ideas, knowledge and health standards have changed since then, and foresight is necessary to conserve the investment in the sewage plant and to prevent hazard to health and nuisance.

## Some One Has to Get Hurt to Win a War

Much emphasis has been placed on winning the war by buying bonds or savings stamps. There is a real danger that the people of this country will feel that the war can really be won by digging down in their pockets now and then, according to their capacity. There isn't any magic way to win a war except to outfight the enemy. Someone has to get hurt; and the sooner the public realizes this the better. Another thing we had better forget is the oft-repeated saying that our tremendous resources "guarantee" a victory. The repetition of this statement and the "buy a bond and win the war" talk are making too many people in this country think "this war is a cinch—just give us a little time; they can't last." Such an attitude is dangerous to the very existence of the nation. What we need is to begin to win the war—and there is, after all, only one way to accomplish that—fight! And fighting is not done by money and machines; they are only the means used by the men—your friends and mine and our friends' sons—who do the fighting.

## War Emergency Items

A number of matters are treated briefly in this issue which must be acted upon promptly, if at all; and in order that they may not be overlooked we are grouping them together under the heading "The War Emergency." These have to do with the latest chlorine priority orders; A.W.W.A. recommendations for wartime chlorination; supplies to be kept on hand for emergency repairs by sewerage and water works departments; air raid recommendations; opportunities for sanitary engineers with the U. S. Public Health Service; and coming conferences on wartime problems.

Similar matters will, we anticipate, require emergency attention each month "during the duration," and we suggest that readers of this and succeeding issues turn first to the page bearing the above heading.

## Return of the Wood Age

With limited availability for other than war needs of steel, copper, tin, zinc and most other metals, public works and utilities will find it necessary to rely largely on concrete and wood for construction materials; and reinforcement for concrete is difficult to obtain. Fortunately there is abundance of lumber, and this offers more possibilities than most of us realize.

Our great-grandfathers had no steel and little iron, but they constructed not only buildings but also bridges, dock walls, plank roads, water tanks—practically everything—of wood. Many of the structures of that wood age are still in existence. In returning to the wood age we have a great advantage over our ancestors in the improvements made since then, such as creosoting and laminated construction, and others developed by a special Federal bureau. The ingenuity of our manufacturers has already produced several wood substitutes for steel; for example, a leading manufacturer of corrugated culverts, finding its steel supply limited, has developed a wood culvert as a substitute. Wood is being used for arches up to 125 and 150 ft. span. Many of our counties construct their short-span bridges of wood (see PUBLIC WORKS for March), and composite timber bridge floors demonstrated their usefulness even when other materials were available. (See PUBLIC WORKS for December 1937.) We expect to publish a series of articles dealing with the use of wood for many kinds of public works.

## Save Tires, Save Oil, Save Lives

Do Not Drive Over 35 Or 40 Miles An Hour

According to the Public Roads Administration, a used tire that is serviceable for another 10,000 miles under normal driving will go 12,000 miles at 40 mph and 14,000 at 35 mph. Also there will be a saving of 8% and 13%, respectively, in gasoline. And there will be fewer accidents.

For pleasure riding, time is more important than distance covered, and tire life in hours rather than mileage would be increased 60% and 100%, respectively, by such reduction in speed.

Then be patriotic with your savings thus made and

**BUY U. S. SAVINGS BONDS**



## **The Sewage Treatment Works of Hammond, Indiana**

By **CLARENCE A. MASON**  
City Engineer, Hammond, Ind.



Clarence A. Mason

**Sewage from a city of 70,000, most of which must be pumped by three plants, is treated in one 30 mgd plant by activated sludge and heated digestion, with a 50,000 cu. ft. gas holder.**

**E**ARLY in 1938 the City of Hammond was mandated by the Indiana State Board of Health to construct a sewage treatment plant so that it should cease polluting the Grand Calumet and Little Calumet rivers and Lake Michigan, into each of which it was discharging its sewage. The Grand Calumet passes through the central portion of the city in a generally westerly direction and about half of the area within the corporate limits drains to it. That part of the city south of this drains to the Little Calumet river, which constitutes the south corporate line of the city; and the northern part of the city drains to Lake Michigan. The Grand Calumet is largely a lake-level stream and the flow in it may be either east or west, depending to a large extent on direction of the wind and other weather conditions; which is not favorable for disposal by dilution of the sewage and industrial wastes of a large city.

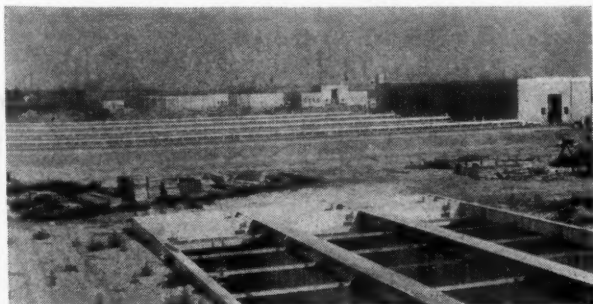
After much political agitation the Common Council, on Oct. 13, 1938, created by ordinance the Sanitary

District of Hammond, coinciding with the corporate limits of the city. To govern and administer the district, a Board of Sanitary Commissioners was formed, consisting of three members. The present members are Leo Besozzi, a consulting engineer, appointed by the State Board of Health; Clarence A. Mason, city engineer of Hammond; and Joseph E. Haney, a chemist and druggist, appointed by these two members.

This board is vested with wide powers, including those of constructing and operating a sewage treatment works with the necessary intercepting sewers and appurtenances; the issuance of general obligation bonds of the Sanitary District; the levying of taxes, condemnation of property, and virtually all of the powers of a separate municipal corporation. Statutes limit the borrowing power of the districts to 2% of the assessed valuation of the real and personal property within the district; which valuation as of March, 1, 1941, was \$91,396,665.

The Sanitary Board at once employed Charles H. Hurd, of Indianapolis, as consulting engineer. Previous to this the city engineer's office had filed with PWA a request for a grant of \$1,437,734 for the construction of sewage treatment works, which was allowed and on Dec. 31, 1938 ground was broken for the first outlying pumping station to pump sewage from the northern section of the city to a treatment plant on the north side of Grand Calumet river; which station was put in operation on Jan. 6, 1940.

The city is about 10 miles long north and south and 2 to 5 miles wide and is divided into 10 sewerage districts. To bring all the sewage to the treatment plant, three pumping stations are necessary, the northern station just referred to; a second, pumping the sewage collected by an interceptor built across the entire south



Foreground, effluent end of one battery of primary settling tanks. Background, gas control building, digestion tanks, sludge control building, administration building.



Welding 50,000 cu. ft. Hortonsphere, 45 ft. 6 in. diameter.

end of the city; and the third pumping the sewage in the southeast section of the city. The sewage in each case is pumped through a force main to a higher point from which it can flow by gravity to the treatment plant.

The city has a combined system of sewers, with necessarily flat grades and practically all constructed below ground water level, so that there is high infiltration. The smaller sewers are mainly vitrified clay. Most of the larger ones are brick or concrete, some of the older ones of entirely inadequate capacity causing serious flooding. Some of them have been seriously attacked by strong industrial wastes.

### The Treatment Plant

Hammond has a population of 70,000. The average water pumpage is 12 mgd but the sewage flow is estimated at 18 to 20 mgd, giving an idea of the amount of infiltration. The treatment plant is designed for 30 mgd from a population equivalent of 100,000.

Sewer gaugings taken before the plant was designed showed a flow of approximately 18.31 mgd; total suspended solids, 28,600 pounds per day; 18,440 lb. of B.O.D. per day, varying from 6 to 190 ppm for a 24-hour period.

The activated sludge method seemed that best suited for the conditions in this city. It was estimated that chemical precipitation would cost approximately \$17.87 per million gallons, and bio-chemical treatment \$16.36; but activated sludge was estimated at only \$15.74, (although the construction would cost more than the others), the necessary power could be obtained from the sludge gas, and the sewage of all Great Lakes cities has proved amenable to this method of treatment. Moreover it was believed that Hammond would increase greatly in industrial development and population and the character of the bodies of water receiving

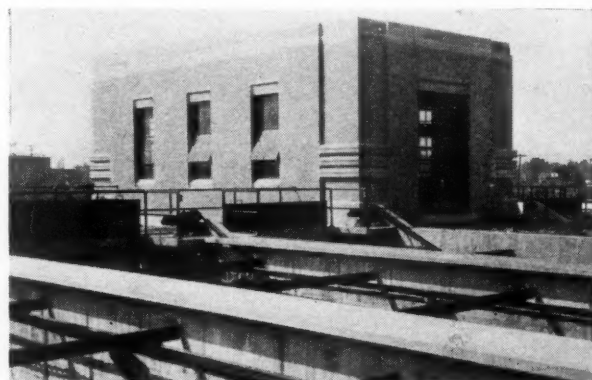
the sewage necessitated that the removal of organic matter and putrescible solids be as complete as possible.

The original project provided for two treatment plants, but further study showed that if only one were built the cost over a period of years would be materially reduced. The plans contemplate the future installation of a complete system for disposal of the sludge, but funds are not available for its construction at present.

All sewage entering the plant first passes through mechanical bar screens, the removed screenings being ground and returned to the sewage, which is then pumped to pre-aeration tanks, where it is aerated for 20 or 30 minutes with diffused air with spiral flow. The effluent flows to primary settling tanks, where skimmers remove grease, oil and floating particles, and grit is removed by an air ejector system. The retention here is as brief as possible in order that the dissolved oxygen received by pre-aeration may not be unduly depleted.

The effluent then goes by gravity to the aeration tanks, where the spiral flow, diffused air system is used. The detention period here varies from four to six hours. The effluent is retained in final settling tanks approximately two hours.

The sludge is drawn off to four heated digestion tanks. It is hoped that these will furnish enough gas to enable us not only to heat the tanks but also to run the blowers and not have to use the electric blowers except in case of accident. If enough gas is not ob-



Primary treatment building and primary settling tanks.

tained, the Board will consider seriously the adding of ground garbage to the sewage, which will undoubtedly, we are assured, furnish all the gas we will need, and probably excess power to be fed back to the local utility. A 50,000 c.f. Hortonsphere has been provided for storing the excess, and a cross connection so that, in case of accident or insufficient supply, we can purchase gas from the local utility.

Provision has been made for future additions to any unit. Filters for dewatering sludge and an incinerator for burning it will be constructed later when funds become available. The administration building, which houses the laboratory and the office of the Board as well as of the superintendent, is separate from the power plant to prevent noise and vibration, but is so located as to give the superintendent a complete view of all buildings in the plant.

On the 4th of April, 1941, the Board received an additional grant of \$70,531 from the Public Works Administration, and is supplying \$86,000 for our share. This is to be used for the extension of the out-fall sewer 300 feet into Lake Michigan (to be used only in case of excessive storm water); fill at the site;

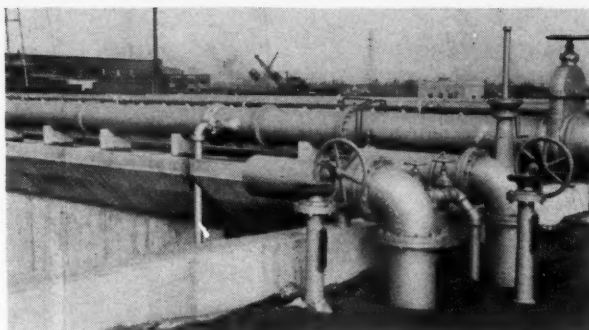
roads; sidewalks; lighting system; emergency lighting sets for the stations; laboratory equipment and benches; three small interceptor sewers, etc.

The equipment contained in the plant and the manufacturers of same are as follows:

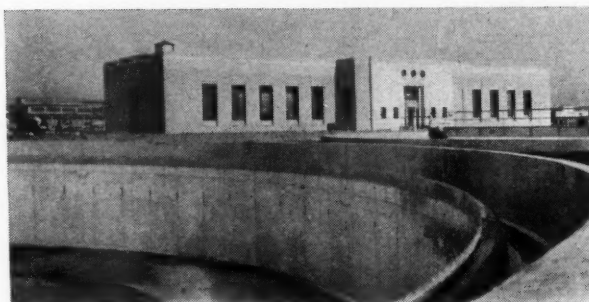
Sewage pump, Worthington Pump and Machinery Corp.; Dayton-Dowd Co.  
 Bar screens, Jeffrey Mfg. Co.  
 Screening grinders, Jeffrey Mfg. Co.  
 Grease skimmers, Jeffrey Mfg. Co.  
 Air diffusers, Norton Co.  
 Grit removers, The Dorr Co.  
 Sludge collector equipment (Final settling tank; Primary settling tank), Jeffrey Mfg. Co.  
 Digestion tank (tank covers), Dorr Co.  
 Gas utilizing equipment (Gas engines), Cooper-Bessemer Corp.  
 Boilers, Bryant Heater Co.  
 Gas holder, Chicago Bridge & Iron Co.  
 Laboratory equipment, W. W. Kimball Co.  
 Sludge pumps, Chicago Pump Co.

Our sewage treatment plant was placed in initial operation during August, 1941. Since September fifteenth, 1941, all of the sewage and industrial wastes reaching the plant through the city sewer system have received complete treatment, excepting during periods that acid iron wastes contained in the sewage reached the plant. It has been found necessary during those periods to dump all of the sewage which would normally enter the plant into the Grand Calumet river.

The treatment plant now has twenty-three men on its staff and four employees, including the superintendent, in the office. Four of the twenty-three men also act as operators of the Atchison Avenue Pumping Station on the far north side. The South Side Pumping Station at Columbia Avenue and 177th Street is a fully automatic station, requiring only periodic attendance. This plant was placed in operation during the first week in March, 1942. The only other outlying plant, which is on the south side at Kennedy Avenue and



Air piping at aeration tanks.



Final settling tanks in foreground. Power building in background.

Michigan Avenue, will be ready and placed in operation during the month of April, 1942.

The Board of Sanitary Commissioners, who operate this plant, have issued instructions that all trade wastes originating in the city should be taken into the plant, with only one exception, that being a small amount of pickling liquor from one steel plant. This program was adopted by the Board at the start of operations. During the past month a great deal of agitation has originated in Chicago relative to the pollution of the south end of Lake Michigan. The decision to accept all trade wastes has been of great advantage to the City of Hammond in that discussion. This Sanitary District is one of the very few in the State of Indiana that is attempting to treat all trade wastes. This procedure of course does not produce the best operating results, but it does at least place the District in a very advantageous position when the matter of pollution of Lake Michigan is being discussed.

### Reservoir Cut in Solid Rock

An unusual water storage reservoir is nearing completion at Broken Arrow, Oklahoma, where the Work Projects Administration has hollowed out a basin on the top of a hill of solid rock. The completed storage tank will have a capacity of 1,450,000 gallons, with a 70-foot inside diameter, a 72-foot outside diameter, a 15-foot inside depth and a 16-foot outside depth.

The basin was walled with reinforced concrete and a bottom, or floor, was similarly made of concrete. Footings were 16½ feet into the rock. Thirty-two tons of reinforcing steel are being used in the construction, and in hollowing out space for the tank it was necessary to remove more than 3,000 cubic yards of rock.

The tank is situated on a hill 150 feet high, thus providing adequate pressure for fire fighting purposes. Water will be pumped into the tank through a 10-inch inlet line which also can be used as an outlet by an adjustment of valves.



Storm water pumping equipment.





County Engineer Wardrip reading Public Works at his desk.

**E**FFICIENT and non-political personnel, a definite construction procedure and cooperation with Federal agencies has made it possible to set a record in Elk County, Kansas, of building 50 miles of roads and maintaining 750 miles on \$60,000 a year.

Located at the eastern edge of the Flint Hills of Kansas, Elk County has a population of 8,039 and an assessed valuation of \$13,398,662. The western two-thirds of the county is a black limestone soil interspersed with limestone outcroppings; in the eastern one-third this changes to a sandy soil with heavy sandstone ledges and bluffs. The topography is hilly in the upland to rolling in the bottoms, with a variation of 600 feet in elevation.

With the exception of 60 miles of State-maintained roads (one crossing the county in each direction), all roads are under the jurisdiction of the County Highway Department. On January 1, 1941, the status of the county system was as follows: Blacktop, 2 miles; graded and surfaced with crushed rock, 351 miles; unsurfaced mail routes, 151.25 miles; maintained dirt other than mail routes, 244.25; open roads not maintained, 22.5; total 748.5 miles. Two hundred miles of this has been graded, drained, and surfaced during the past four years.

The selection and the policies of the administration and operating personnel have been the chief contributing factors in the accomplishments of the Department. Under the State Statutes, one commissioner is elected from each of three predetermined districts. The statutes charge these commissioners with the indirect administration of all county highway activities, including hiring and dismissal of personnel, purchasing of supplies and materials, and determining the operating procedure in construction and maintenance. The Board of Commissioners in office at the time our record was made realized that election to office did not make them trained personnel men, purchasing experts, mechanics and engineers but they chose to act in an advisory and governing capacity only. Much credit is due these broad-minded commissioners, who put the welfare of the department ahead of personal vanity and petty party politics and delegated such duties to trained men.

The County Engineer is appointed by the board, and next to him are three road foremen, a bridge foreman, and a shop foreman; while working under the foremen are the mechanics, operators, form builders, and laborers. Each of these is directly responsible to the man above him, who has full power of hiring and dismissal. A man with a grievance has the right of appeal to the engineer or commissioners, but a foreman's decision is rarely reversed.

## Maintaining 750 Miles

By J. J. WARDRIP  
County Engineer, Elk Co., Kans.

For convenience in operation, the county is divided into three districts with a foreman in charge of each. Each foreman is in charge of all construction and maintenance in his district except the construction and major repairs on bridges and culverts, which are made by the bridge foreman and crew. Each road foreman has at his disposal 3 motor graders, 2 trucks, 1 rock crusher, one 75-horse power tractor, one 12-foot blade grader, one 2-cu. yd. fresno and all necessary small tools. The bridge foreman has two trucks, two 7S mixers, one rock crusher and necessary small tools. The county also has an elevating grader, an air-compressor and a heavy ripper for use in the districts where such equipment is needed. While it is most convenient in normal operation to observe district lines, the engineer may move crews and equipment as often as is necessary on large WPA jobs.

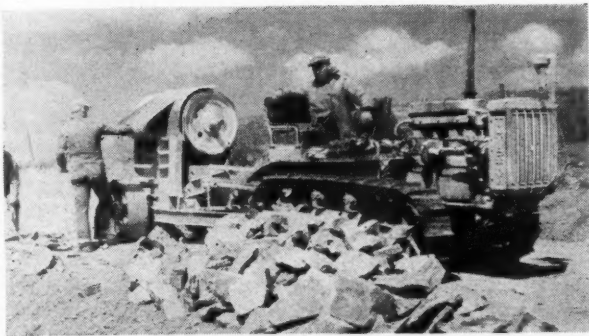
In the past two years the WPA has had a competent engineer in charge of this county, who has been in agreement with the county's administrative policies. He has disregarded local politics and has worked with the county engineer in the selection of foremen, based on their ability and past records, which has enabled our county to obtain the best WPA unit costs in the state; costs that are for the most part below contract prices. Since the major part of our construction is done as county sponsored WPA projects, much credit for our success should go to its employees who have been directly responsible for our operations. This organization has been looked upon, in our county, as a construction agency rather than one for made work relief. At all times machine construction methods have been given preference over makeshift hand labor, in order to decrease costs. This policy has kept the morale



Concrete tile yard operated by Elk County.

## es ad and Building 50 Miles of New for \$60,000

Elimination of politics, careful selection of personnel and careful selection of construction equipment made possible the building of 50 miles of road and 750 miles on \$60,000 a year.



One of three roadside crushers operated by Elk County.



Completed road surfaced with crushed limestone.

of the workers and foremen much higher than in counties where such procedure is not practiced. As far as governmental red tape would permit, the WPA has followed the county's plan of giving authority to the man directly in charge. The importance of delegating authority and trust in trained personnel cannot be overstressed; without it the county needs not an engineer but a magician to operate its highway department efficiently and economically.

Other governmental agencies have given full cooperation to the county. Intelligent young men, interested in engineering, have been assigned from the National Youth Administration rolls to the engineer's office, and have served as chainmen, rodmen, draftsmen and at times as instrument men. Because of their ability and desire to learn, they have made better help than the uninitiated would think. The result is a material saving to the county and a direct service to the boys and the community. Some of the past N.Y.A. employees are now well on their way to a degree in engineering.

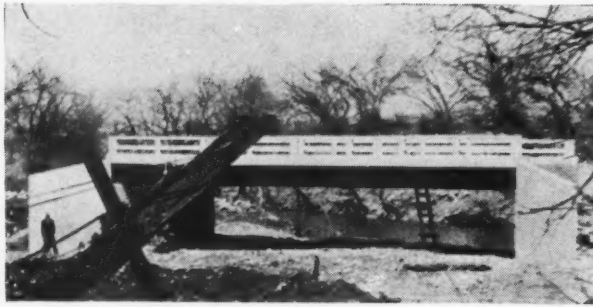
The statements of savings are based on a complete system of cost accounting. A perpetual inventory, posted daily, is kept of all supplies, equipment, and material. All repairs, shop labor, oil and greases are charged from stock to each piece of equipment on a shop card, or shop requisition; all material and lost or broken small tools are charged to the foremen, who in turn charge them to a job on their daily job report. The daily job report, which is required of each foreman, carries the job number, location, type of work, amount expended for labor, material and equipment rental; the total for each item is carried forward each day so the amount expended can be determined at a glance. These are made in triplicate, as are all other accounting forms. The equipment rental rates are based on operating costs, depreciation, and repairs, and are such that the machine will pay for replace-

ment during its useful life. Purchases of mechanical parts, tools, etc., are made by the shop foremen. Sealed bids are taken on all major purchases such as tires, oil contracts, gasoline contracts and equipment, and are awarded to the low bidder who meets specifications.

Since there are 395 miles of roads formerly maintained by the townships which need to be brought up to standard grade and surfaced, some method of preferential rating must be used in the selection of construction projects. From aerial survey pictures, loaned to the department by the AAA office, the N.Y.A. boys have made a large-scale map, showing all drainage areas, mail routes, school bus routes, schools, churches, cemeteries, farmhouses and all other information pertinent to the selection and operation of projects. This information is supplemented by a traffic-density map prepared by the state in conjunction with the Federal Planning Board. With the above information, and with current observations made by the engineer and foremen, it is possible to select for improvement those roads which will give the most public benefit for the money expended. While local pressure groups are given a courteous audience, their influence has been negligible on the selection of future improvements. The public as a whole usually is pleased to know that some logical scientific method of selection is used.

In operating on a budget as small as ours, it is necessary to keep maintenance costs as low as possible if any money is to be used for new construction. Primary attention is given to keeping the riding surface smooth and passable at all times. All roads are patrolled after each rain or snow. While maintaining these roads, the operator notes any necessary repairs; small jobs such as cleaning a culvert or draining a mud hole are done by him at the time, and larger repairs are reported to his foreman. A power mower





50-ft. 1-beam bridge with concret abutments and floor. 24 ft. roadway, H-15 loading.



Three-span 10 x 5 x 26 ft. concrete box culvert.

constructed from an old automobile is used to mow weeds at least once each year on all roads and more often where needed. Snow removal is no major problem here, since only once every few years is the fall so heavy that it cannot be removed with a motor grader. All maintenance work is accounted for on "maintainer" reports and daily odd job tickets. The average cost to the county is approximately \$25 per mile per year.

The improvement of former township roads (which accounts for nearly all projects) is practically new construction, since it is necessary to acquire more right-of-way and build new grade and drainage structures. No work is done on less than 60-foot right-of-way, which necessitates obtaining usually a 10 foot strip on each side as well as borrow pits and channel changes. Where new alignments are required, it is necessary to obtain 60-foot additional right-of-way. Since a good road is a definite asset to abutting property, the county has made it a policy that all necessary right-of-way be donated. The only exceptions made to this are where large borrow pits, channel changes or new alignment have done a considerable and material damage to the adjacent land; at such times the limit of the price paid has been one and one-half times the assessed value of the land taken. Since all land owners realize that the county is trying to make limited funds go as far as possible and are using sound business practices throughout the department, few protests have been made concerning our method of obtaining additional right-of-way.

Grade widths are made 24, 26 or 28 feet depending on traffic requirements. Ditches are made 4 ft. wide and 2 ft. deep, with a flat bottom, and a 2½:1 shoulder and a 2:1 backslope. Surfaced widths are usually 22 feet. Except in cuts and fills, which are kept to a minimum consistent with good alignment for the amount and type of traffic served, all grading is done with a blade grader, or elevating grader and motor grader. The dirt is removed from the backslope and

ditch to the shoulder by either blade or elevating grader and is distributed and smoothed down with a motor grader.

All drainage structures up to 300 square feet of opening are made of reinforced concrete, either tile or box culverts. Tile are used on all locations requiring an opening less than 3 feet by 3 feet, which is our smallest standard culvert. The topography of the county is such that all structures are designed using a Talbot's coefficient of .5 to .8 depending on local conditions.

Lap-joint tile are made to lay 36 inches and reinforced to meet A.S.T.M. specifications. Metal forms, base plates and headers are used in the construction of these tile. They are poured one day and the forms removed the next. Two men with a 5S mixer are able to pour 6 feet of 15-inch, 12 feet of 18-inch, 6 feet of 24-inch, and 6 feet of 30-inch each day. The cost of the tile is only about half that of any competitive product on the market. Due to the quantity used, the annual saving has been approximately \$3,800, besides giving employment to local labor.

Standard concrete box culverts are designed for an H-12 loading with 1 foot of fill, plus 37% for impact. In design 3,000 lbs. per square inch for concrete and 18,000 lbs. per square inch for steel are used, which is considerably below tests made on job samples, and therefore is well on the safe side. Careful attention must be given to proportioning, mixing and placing if concrete in excess of 3,000 lbs. per square inch is to be obtained. When these standards were first adopted it required no small amount of checking design to get WPA to accept construction so much lighter than state standards. The fact that this design is more than adequate was proved when a 12-mile county road was used as a detour from one of the main state highways for several months, and the drainage structures showed no signs of overstress. The large saving to the county is quite evident when the quantities of a state standard and a county standard culvert are compared: for a 5 ft. by 5 ft by 26 ft. culvert, the state standard is 25.2 cubic yards of concrete and 2,737 lbs. of reinforcing steel; the county standard is 15.9 cubic yards of concrete and 1,502 lbs. of reinforcing steel. This constitutes a saving of 37% on concrete and 46% on reinforcing steel. The saving for each individual culvert is not large in itself, but in view of the fact that 90% of the county's bridge fund is expended for the construction of reinforced concrete culverts, in the course of a year's construction this is a noteworthy saving. The lighter construction has made no increase in unit costs as will be noted from the summary of a typical 12-mile project which follows:

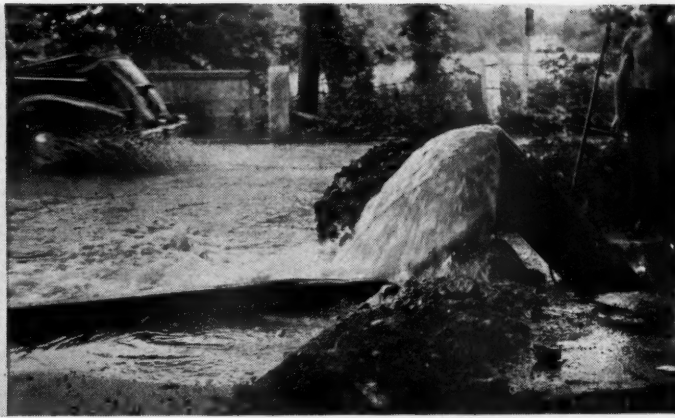
47,788 c.y. earth excavation .....	\$ .069	\$3,277.23
9,269 c.y. rock excavation .....	.61	5,654.09
1,253 c.y. culvert excavation .....	.96	1,202.88
5,456 rods fence moved .....	.357	1,977.79
8,850 c.y. rock hauled (3.4 mi. av.) ....	.35	3,097.50
8,850 c.y. rock crushed .....	.392	3,469.20
345 ft. of 15" R. C. pipe installed .....	.80	276.00
168 ft. of 18" R. C. pipe installed .....	.96	161.28
195 ft. of 24" R. C. pipe installed .....	1.55	302.25
192 ft. of 30" R. C. pipe installed .....	2.25	433.92
31,431 lbs. reinforcing steel .....	.030	942.93
261.6 c.y. concrete .....	13.55	3,544.68
Clearing of right-of-way, including:		
529 trees 12" to 30" in diameter, 28,560'		
hedge grubbed and 10,380' hedge side		
trimmed .....		1,959.00
Total		\$26,298.75

(Continued on page 30)





Machine emerging from 16" main.



Water flowing from 16" main after cleaning.

Courtesy National Water Main Cleaning Co.

## Cleaning Over Three Miles of Main in Six Hours

By CHARLES W. DAVIS

Superintendent of Water Works, Petersburg, Va.

PETERSBURG, VA., obtains its water from a canal owned by the Virginia Electric & Power Co. and used to operate a hydro-electric plant. This water is taken through 17,000 ft. of 16" pipe to the filtration and pumping plant at the opposite end of the city, discharging there into settling basins whose elevation is 65 ft. lower than the canal. This long intake is due to the fact that, when the plant was built, the source of supply was a small stream and the plant was located near it.

According to measurements taken in the fall of 1940 this line was delivering 1,800,000 gpd by gravity, which was increased to 3,750,000 gpd by using a booster pump rated at 4,000 gpm at 100 ft. head. Each of these rates indicated a value of 70 for C in the William & Hazen formula. The normal consumption of Petersburg is 2.5 to 3.5 mgd, which necessitated pumping for ten to twenty hours a day at a power cost of \$5,000 a year.

When the city agreed to furnish Camp Lee with a water supply up to 3 mgd, its own maximum consumption reaching 3.5 mgd, it became necessary to increase the amount of raw water reaching the plant to 6.5 mgd and it was decided to install a 20" transit pipe paralleling the existing line, thus eliminating the necessity of pumping. However, because of delay in reaching an agreement with the War Department relative to furnishing the water and difficulty of constructing the new line, it was realized that it could not be completed before the camp would be requiring 2 mgd or more. We therefore investigated the possibility of furnishing this amount by cleaning the existing line, and on February 15 contracted with the National Water Main Cleaning Co. to do this at a cost of 7 cts. per foot.

Prior to cleaning the main, a 6-foot section of pipe was cut out at each end of the line and the sections replaced using Dresser couplings. This was done in order to shorten the time that the line would be out of service. The day that the main was cleaned, we shut

off the line at 7 A. M., the two joints previously cut at each end were removed, and the cleaning machine was jacked into the open end of the pipe through a funnel and the section of pipe replaced. This part of the work was completed by 9:15 A. M., at which time the pump was started, with a throttled valve, behind the machine. There were eleven fire hydrants and one blow-off valve on the line, all of which had been opened, which enabled the incrustation to be washed out at these various points. As the machine would pass the hydrant, it would be closed as soon as the water ran clear. The machine came out of the lower end of the pipe at noon, having made the three mile trip in less than three hours. The lower section of pipe was coupled back and service was restored on the line by 1 P. M., making a total of six hours the line was out of service.

Tests run after the cleaning indicated that the gravity flow had increased from 1,800,000 to 3,200,000 GPD, an increase of 78% with a coefficient "C" of 125 against 70 before cleaning. Using the same pump, the flow increased from 3,750,000 to 6,100,000 GPD, an increase of 63% with a coefficient "C" of 125 against 70 before cleaning. The total cost of this work was \$1,300 including cutting the main, etc. For a delivery rate of 3,750,000, the maximum before cleaning, the power savings were \$650 a month, so the cleaning paid for itself in less than three months.

During a hot, dry spell in May, when the camp and city consumption combined rose to nearly 6,000,000 gallons per day, it was observed that the delivery of the line had dropped down to 5,500,000 gallons per day, a loss of 10% in three months.

Shortly after this time, portions of the new line were completed, and in August the entire new line was placed in service. There has been no opportunity since then to check the delivery of the old line to determine whether the flow has continued to decrease.

The above is a paper read before the Virginia section of the American Water Works Association.

# Insuring the City's Sewerage Investment

By GERRY PAULY

Chairman, Public Relations Committee, Sheboygan Board of  
Fire & Casualty Underwriters

**T**HIS paper pertains to the various types of insurance for protecting sewage treatment systems against losses that might occur. Fire Insurance should in all instances be written for the full value of the plant and its machinery and contents, keeping in mind that 80%, 90% or even 100% of co-insurance would be proper for this form of insurance. Your rate is naturally low because of the usual construction of buildings of this type, and for that reason your insurance men can show you that it will be beneficial to you to carry about full value coverage. A blanket form should be used including the contents; it will not be hazardous to do this because the contents will not fluctuate in value, as it might in an industrial plant. Caution should be taken in the Exclusions Clause, particularly in regard to foundations and walls below the surface of the ground. For no additional cost the records, clerical and otherwise, can be insured for the cost of transcribing these records, together with the cost of books, bindings, and necessary stationery and cards needed in the transcription. A Loss Adjustment Clause can be placed if the insurance is written in more than one company (as it most likely will be), so that when a loss does occur, only one proof has to be signed to secure payment from the insurance carriers. This eliminates a lot of work if there are several companies involved.

The next important protection is Extended Coverage, which is particularly applicable to your plants. The perils insured against include windstorm, cyclone, tornado and hail, explosion, riot, riot attending a strike, aircraft, smoke, vehicles. Among these, of course, the explosion is the important one. It was due to the fact that locally we had protected the city in this manner that an explosion in a digester, which occurred in December, 1940, was settled without question, the amount of \$10,000 for the loss being paid to the city.

Where treatment plants have greenhouses it is best to insure these specifically under a separate policy, with windstorm and hail coverage. You will find, as a rule, that greenhouses are excluded under the blanket coverage on treatment plants and, therefore, this separate protection is necessary.

To touch for a moment on the matter of auto insurance: As a rule where there are cars used by plant operators, these cars are insured under the fleet coverage for all city-owned automobile equipment. If there is a separate sewerage district committee, then, of course, the operation of these cars would come under their jurisdiction. If you have trucks or motors that are operated only on the premises and not on city streets or highways, public liability and property damage insurance would not be necessary on these units. If you have employees that have privately owned cars that

are used in line of duty, you can protect yourselves by asking these individuals to produce their auto policies, and name therein the individual owner and the city as joint assured (I speak in this respect only insofar as my knowledge and the rules for the State of Wisconsin apply).

Owners' Public Liability Insurance with sufficiently high limits, (possibly \$10,000 for any one individual accident where one person is involved, and \$100,000 where more than one is involved) would be a very important type of protection. There always arises the question whether a municipality can be held liable for an injury to the public, but it yet has to be established definitely as to the final decision in cases of this kind. We do know that a city can be sued, and your carrier will serve you by investigating a claim, defending you in case of court action, and pay all costs taxed against you, even though the case might be groundless, false, or fraudulent.

If you have elevators in your building, and they are of the passenger type, Public Liability Insurance on them should be considered. Of course, if the elevator is strictly for carrying materials and is operated and used solely by your employees, that would not be necessary because they would be covered under the Compensation Insurance.

Workmen's Compensation Insurance is similar to the Auto Coverage, which I mentioned above, and is either included in the City's Compensation Policy, or purchased separately by you. The laws in the State in which you operate govern the payments and benefits paid to your employees in the event of an accident of any kind while the employee is on duty.

Boiler Insurance covering damage done to yours or other people's property, and to injury to the public (not your employees) is a necessary form of protection. The inspection service given by the better known Boiler Insurance Companies, where an external and internal inspection is made periodically, is worth the premium cost to you. Boiler Insurance is of benefit from the standpoint of economy in operation; feed water analysis and disclosure of weakened tubes or flues, which brings to your attention the possible cause of an accident before it might occur.

Electrical Machinery Insurance should cover all your motors, excitors, etc., against possible loss by mechanical breakdown or otherwise, and insures the units themselves in the event of a loss.

When giving consideration to your Fire, Extended Coverage, and other phases of insurance, it is advisable to consider placing the unearned premium endorsement to these policies. This endorsement covers the premium

(Continued on page 40)



A 2 inch surface in Kenosha Pass, Colo., constructed by Road-Mix method using asphaltic oil and crushed rock.

## Specifications for Bituminous Surfaces for Highways and Airport Runways

The third and final installment, of which the first was published in the February issue. In this issue, road mix surfaces, dense graded type.

### II. Dense Graded Road Mix

The following specification, which is slightly condensed from preliminary specifications for this type by the U. S. Public Roads Administration, covers the use of medium curing cutback asphalts. Other types of bituminous materials may be used, but their use may result in the necessity for changes in the specifications. In general, this type of surface should not be built except under skilled supervision.

1. *Description.*—*a.* This item shall consist of a wearing course composed of aggregate and bituminous material mixed in place on the prepared roadbed, constructed in accordance with these specifications and in conformity with the lines, grades and typical cross section shown on the plans. Aggregate shall consist of either all new aggregate (case 1), a blend of new aggregate and aggregate present in the existing road (case 2), or aggregate present in the existing road (case 3), whichever is called for in the bid schedule.

*b. Determination of Percentage of Bituminous Material.*—The percentage of bituminous material by weight, to be added to the aggregate shall be between  $3\frac{1}{2}$  and 7 percent of the weight of the dry aggregate. The exact percentage to be used shall be fixed by the engineer on the basis of preliminary laboratory tests and field sieve analysis of the aggregate furnished.

*c. Job Grading and Allowable Tolerances.*—The bid schedule will indicate the particular grading given in Table 1 to which new aggregate, if used, must conform. The grading of new aggregate furnished for any "run" (one full day's mixing operations) shall be

of such uniformity that percentages of material passing the Nos. 4, 10, and 200 sieves for any one sample shall not vary from the averages of all samples for the "run" by more than the following tolerances:

Material Passing	Percent
No. 4 sieve.....	+5
No. 10 sieve.....	+5
No. 200 sieve.....	±2

2. *Materials.*—*a. New Aggregate.*—(Case 1). New aggregate for gradings A, B, C, and D shall consist of coarse aggregate of gravel, crushed to size as necessary, or crushed stone, in either case composed of hard, durable pebbles or stone fragments, and a filler of finely crushed stone, sand, or other finely divided mineral matter. New aggregate for grading E shall consist of fine gravel and sand, disintegrated granite or other similar granular materials. The portion of the material retained on a No. 4 sieve shall be known as coarse aggregate, and that portion passing a No. 4 sieve shall be known as filler. The composite material shall meet the requirements for one of the gradings given in Table 1, whichever is called for in the bid schedule, using A.A.S.H.O. Methods T-11 and T-27.

New aggregate shall be so graded within the limits given in Table 1 that at least 10 percent of the total aggregate shall pass a No. 4 sieve and be retained on a No. 10 sieve. No intermediate sizes of aggregate shall be removed for use in the seal coat or for other purposes without the written consent of the engineer.

When one of the gradings A, B, C, or D is specified, the coarse aggregate shall have a percent of wear of





Blading and shaping.

not more than 50 at 500 revolutions as determined by A.A.S.H.O. Method T-96 (Los Angeles Rattler Test). For all gradings that portion of the filler, including any blended filler, passing a No. 40 sieve shall have a plasticity index of not more than 6, as determined by A.A.S.H.O. Method T-91. The composite new aggregate shall be free from vegetable matter, lumps or balls of clay, adherent films of clay, or other matter that will prevent thorough coating with bituminous material. The aggregate shall be of such nature that a thorough coating of the bituminous material to be used in the work applied to it will not slough off upon contact with water. The bituminized aggregate shall have a swell of not more than 1.5 percent as determined by method 1 of A.A.S.H.O. Method T-101.

*b. Blended Aggregate.*—(Case 2). Blended aggregate shall consist of a blend of aggregate present in the existing road and added aggregate. New aggregate for blending shall meet the requirements given above for new aggregate. Additional aggregate having the grading called for shall be added to the surface in the amounts directed by the engineer.

*c. Aggregate from the Existing Surface.*—(Case 3). Where all aggregate required for the road-mix surface course is already in place, the contractor shall not be responsible for its grading or quality except for removal of oversize pieces. In general, salvaged aggregate to be used for road-mix surface course will consist of material meeting the requirements given above for new aggregate or may consist of selected granular material of other gradings. Any particles of salvaged aggregate that will not pass a 1½-inch sieve shall be removed by the contractor at his expense.

*d. Filler for Blending.*—If filler in addition to that naturally present in new aggregate is necessary, it shall be uniformly blended with the aggregate at the crushing and screening plant. If the blended aggregate needs additional filler, blending shall be performed on the road. The material for such purpose shall be obtained from sources approved by the engineer, shall be free from lumps, and shall not contain more than 15 percent of material retained on a No. 4 sieve.

*e. Bituminous Materials.*—Medium-curing cut-back asphalt shall be furnished. It shall meet the requirements already given in Section A. The grade (with temperatures of application in degrees F.) shall be MC-2 (150-200), MC-3 (175-225) or MC-4 (200-250) as called for in the bid schedule.

*3. Construction Methods.*—*a. Weather and Seasonal Limitations* shall be as given in Section F, I, Par. 4a.

*b. Equipment.*—The equipment used by the contractor shall include scarifying, mixing, spreading, finishing, and compacting equipment, a self-powered

bituminous material distributor, and equipment for heating bituminous material.

Scarifiers shall be of the 4-wheel type and shall have wheelbases of not less than 15 feet. Blade graders for mixing shall be either self-powered or tractor drawn and shall have wheelbases of not less than 15 feet. Crawler type tractors used shall have street plates or flat treads. Disk, spike-tooth, and spring-tooth harrows shall be so designed that cutting into subgrade can be avoided. Blade graders for laying, shaping, and finishing the mixture shall be of the self-powered type, and shall have blades not less than 10 feet long and wheelbases of not less than 15 feet. Such graders shall not be less than 3 tons in weight and shall be equipped with pneumatic tires. Rollers for compacting the surface shall be of the self-powered tandem type weighing not less than 8 tons each.

Either traveling or stationary mixing plants or other equipment of proved performance may be used by the contractor if advance written approval is given by the engineer, and if the contractor complies with such requirements as the engineer may consider necessary to insure results which would be obtained by use of the specified equipment.

*c. Preparation of Base and New Aggregate.*—(Case 1). When all new aggregate is to be used for the road-mix surface course, the existing base shall be scarified lightly and bladed to uniform grade and to the cross section shown on the plans and shall then be rolled, or watered and rolled, as directed. If so ordered by the engineer, depressions shall first be filled and weak portions of the base strengthened by patching with new aggregate. If shown on the plans and called for in the bid schedule, a prime coat shall be applied to the prepared base as described under Section D before the new aggregate is deposited on the road. New aggregate shall be deposited along one side of the road from vehicles equipped or supplemented with suitable spreading devices. It shall then be windrowed. The aggregate shall be so deposited that each windrow will be of uniform section and will contain the correct quantity of aggregate to provide surfacing of the required width and thickness.

*d. Preparation of Base and Blended Aggregate.*—(Case 2). When aggregate in the existing road surface is to be salvaged and used for blending with additional aggregate, the surface shall first be scarified lightly and bladed to uniform grade and to the cross section shown on the plans. The reshaped surface shall then be scarified again to such depth as is ordered by the engineer and in such manner as to leave a foundation stratum of undisturbed material parallel, both in profile and cross section, to the proposed finished surface. To the material thus loosened, additional aggregate of the grading called for shall be added in the amounts directed by the engineer. The added aggregate shall be blended thoroughly with the loosened salvaged material by harrowing and/or turning with a blade grader. The entire blended aggregate shall be bladed aside and the undisturbed under-stratum rolled, or watered and rolled, as directed. If so ordered by the engineer, depressions shall first be filled and weak portions of the base strengthened by patching with additional aggregate. The material bladed aside shall be formed into a windrow at the side of the road. If shown on the plans and called for in the bid schedule, a prime coat shall be applied to the undisturbed stratum as described under Section D.

(Continued on page 36)

# Disinfection Methods for Deep Wells

By EMIL C. JENSEN

District Engineer, State Department of Health of Washington

## Description in detail of three methods of applying chlorine and of one for sealing the tops of wells.

**O**FTEN the bacteriological analysis of a water sample from a new drilled or dug well shows pollution by coliform organisms. This pollution is from one, or both, of two sources, namely (1) contaminated surface water finding its way down along the outside of the casing and entering the flow through perforations or around the end of the casing, or (2) foreign matter introduced during the drilling process by way of dirty materials and drilling tools. Correction of cause number (1) is up to the well driller. If he has not constructed the well so as to seal out surface water, he should be required to do so by either perforating and grouting or by deepening. This item is of great economic importance to the owner. Cause number (2) can be entirely eliminated by a thorough job of disinfection. Therefore, to save time in determining the root of the trouble, a new well should always be disinfected; then, if positive samples show up, it can be concluded that the well is faulty in construction.

A thorough job of disinfection requires adoption of the method best suited to the physical factors of each case, such as pump setting, depth of suction and log of the well; also a knowledge of the amount of disinfecting agent and contact time required. Following is a discussion of the amount of hypochlorite to use and three methods of application, one of which should insure thorough disinfection under any ordinary condition. These procedures are also applicable to existing wells which have become contaminated.

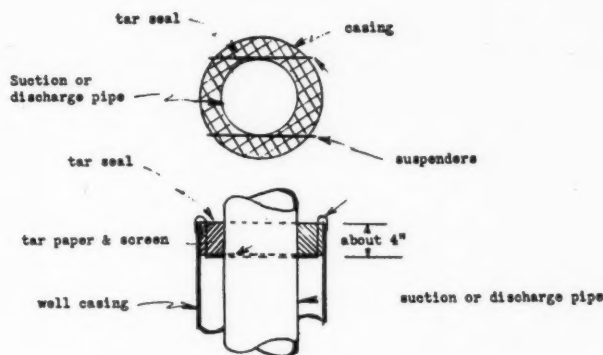
**Amount of Chlorine.**—To provide a factor of safety for variable conditions such as excessive turbidity or a weak hypochlorite solution; a dose of 100 ppm is advised, equivalent to one pound of available chlorine per 1200 gallons, or one ounce for 75 gallons of water. Allowance must be made for the fact that chloride of lime has only 15 to 20% available chlorine, and HTH and Perchloron have 70% available chlorine.

A table showing the required dosage of these products for each 100 feet of depth of different size casings is shown herewith:

Size of Casing	Gallons of water per 100 ft. depth of casing	Amount required for each 100 feet of casing to give 100 ppm	
		H.T.H. or Perchloron (70%)	Chloride of lime (20%)
4"	65	1 1/4 oz.	4 1/2 oz.
6"	147	2 3/4 oz.	10 oz.
8"	261	5 oz.	1 lb. 1 oz.
10"	408	8 oz. 1/2 lb.)	1 lb. 12 oz.
12"	589	11 oz.	2 lb. 8 oz.

(Note: The values given are merely approximate; if only half the prescribed amount were used, adequate disinfection would usually be secured, and if double the amount were used no damage would result.)

In computing the gallons of water in a well that



Method of making seal.

is not cased to the bottom, allowance must be made for the uncased hole or cone at the bottom. This hole is larger than the cased section, especially so if the well has been pumped heavily for some time. If such is the case, then it is recommended that enough volume be provided to chlorinate effectively a cylinder 5 to 10 feet in diameter from the bottom of the casing to the bottom of the well. Allowance may be made for about 50% voids in the soil. The point of this last consideration is to insure disinfection of contamination that was driven back into the voids of the soil during the drilling process or contamination that may have entered through flooding of the well by way of an annular opening.

**Methods of Application.**—1. If enough small hose is available to reach the bottom of the well and the turbine or foot valve will permit passage of the hose between it and the casing wall, then this method can be used. Make up the necessary chlorine solution and pour it directly into the well. Then start the pump and return the entire flow into the well casing by way of the hose. Recirculate for a few minutes until a chlorine residual is obtained from the water being delivered by the pump through the hose. Then lower the hose to the bottom of the well and allow the pump to recirculate the flow from this depth for a few minutes. Then shut the system down and allow it to stand for 24 hours, if possible. Then pump to waste until all traces of chlorine have disappeared, as determined by orthotolidine test.

2. If the well is very deep and an ample supply of water from another source is available, then this method can be employed. Bring the outside water to the well by way of a pipe or hose. Mix the required hypochlorite in 10 or 20 gallons of water in a can or crock fitted with a siphon hose. Turn the flow of outside water into the well at a known rate and feed the chlorine solution along with it at such a rate that all

(Continued on page 42)





# Public Works Equipment and Supplies in Toledo

Practical discussion of the selection of types of equipment, providing storage facilities, maintenance, supplies, personnel, accounting, and public relations.

room should be located at one end of the building to avoid interference with the flow of traffic. Offices should be provided within the building for superintendents and foremen. Such a storage building should be located as near the center of operations as possible, and adjacent to the material supply yards and railroad siding; though such an ideal location is not always available.

In Toledo, prior to the fall of 1937, the Street Division equipment garage was located in the center of the city near the business section. The building was of a design that did not permit its adaptability to modern motorized equipment, and no orderly management of the storage of equipment was possible, which condition caused great confusion and inefficiency. Not being able to obtain suitable quarters with proper facilities near the center of the city, a large building in the northwest section of the city, formerly used for automobile parts manufacture, was leased for a period of years.

This building, with a few changes made by the Street Division forces, is such an improvement over the former building, that, although it is three miles from the center of the city, our operating costs have been reduced from ten to twelve per cent. The reduction in costs was obtained by the orderly manner of storage, resulting in better accessibility to, and closer control of, the equipment.

The building is one-story, ell-shaped, of brick, with steel sash, tile roof and concrete floor. One leg is 240 ft. long and 80 ft. wide and the other is 120 ft. long and 60 ft. wide. The floor plan throughout is broken



Street Division building. Houses 100 pieces of equipment, general offices and shops.

up into a series of stalls, ten feet by twenty feet. The longer leg of the building has two rows of stalls on one side and one row on the other, with a 20-ft. access lane between. The shorter leg has one row of stalls on each side with a 20-ft. access lane in the center. These stalls are numbered and outlined with yellow traffic paint, and each piece of equipment is assigned a definite stall. At the extreme end of the longer leg of the building are located the blacksmith, carpenter, broom-making and equipment-painting shops. Offices for the superintendents of Street Repair and Maintenance, Street Cleaning, and Waste Collection and Disposal, as well as the foremen, are located in a one-story building located adjacent to, and connected with, the building, at the inner corner of the legs of the main building.

In a two-story brick building, 33 ft. by 107 ft., approximately 100 ft. distant from the equipment storage building, are the offices for the Commissioner and for Accounting, the stock-room, and storage space for light equipment. The stock-room occupies the rear

DIVISION OF STREETS																																
AUTOMOTIVE EQUIPMENT OPERATING DATA																																
YEAR OF _____															EQUIPMENT NO.																	
MO.	GAS		OIL	TIRE	LUB.	WASH.	CYC.	TRANS.	ALCO.	BRAKE	PUMP	ELECT.	TOTAL	GARAGE		BATTERY		TIRE		OIL	CYC.	STREET DIVISION SHOPS				TOTAL	TOTAL	TOTAL	MI.	DATE	HRS.	DATE
	SAL.	GALL.												MAT.	LAB.	MAT.	LAB.	MAT.	LAB.			MAT.	LAB.	BURDEN	VO.							
Jan.																																
Feb.																																
Mar.																																
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June																																
July																																
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Sept.																																
Oct.																																
Nov.																																
Dec.																																
Total																																
License No. _____															Motor No. _____																	
Make _____															Type _____																	
Date Purchased _____																																

Ledger form, kept for each individual piece of equipment.

of the basement and second story. Light-weight stock items are stored in the upper story and heavy-weight stock in the basement. Both sections are partitioned off and connected by a stairway. Paralleling the long leg of the equipment storage building is a railroad siding, with a service roadway adjacent.

### Maintenance

Efficient operation of equipment cannot be obtained without proper and adequate maintenance. We have laid great stress on the importance of maintaining the equipment in the best of condition. All operators are required to report the condition of their equipment at the end of each day's work. This report must be filled out, whether or not there is any attention required. A form is provided for this purpose on which are noted the date, number of equipment, mileage, signature of operator, and the notation of the condition of the equipment. These forms are delivered immediately to the Shop Foreman, who allocates the work to his service men when their attention is required. The working hours of the service men are so regulated as to make their services available after the equipment has been returned at the end of the day.

All minor repairs and adjustments such as ignition, carburetor, clutch, brakes, greasing, changing of oil, battery, and tires are made by the Street Division service men. All major repairs such as motor, transmission, and differential, are made at the Municipal Garage.

Special equipment, such as mechanical sweepers, eductors, bituminous distributors, flushers, bulldozers, graders, and rollers, are not only serviced as above, but are completely overhauled by the equipment operators during the winter months. One of the requirements of an equipment operator is that he be capable of such maintenance.

A service truck is always in readiness for minor maintenance of equipment in the field. This truck is fully equipped and heavy enough to tow the lighter equipment.

For individual control of regular service on equipment in the changing of oil, chassis greasing, battery, tires, and anti-freeze, a form is provided that is attached to the inside of the cab in a transparent-front case. On this form is noted the equipment number, type and make, operator's name, specific grades of oils and greases for summer and winter, and tire pressures required for front and rear tires. Space is further provided on which the service man notes the speedometer reading and date of service, with an entry of what was done under the headings of motor oil change, chassis greasing, transmission, differential, clutch and wheel bearings, battery and tires. These cards are regularly examined by the Shop Foreman, which insures that the equipment is receiving proper service.

Any work done in the Street Division Shops is recorded on a shop work sheet, which shows all labor and material charges. A shop work sheet is required for each piece of equipment on which work is done. Any repairs made by the Municipal Garage is likewise reported on a similar form. All of these forms are delivered to the accounting section.

The starting times of the various activities are so staggered as to permit the dispatch and return of equipment with the least amount of delay. Each piece of equipment has its gasoline tank filled at the end of the day's work, for a completely filled gasoline tank is less of a fire hazard and in addition prevents

delays in the dispatching of equipment in the morning.

### Supplies

Prior to the first of each year a budget for the operation of the various activities in this division is submitted for approval. In this budget is included, apportioned by months, the amount of money estimated to be necessary for supplies required to operate the equipment during the succeeding year.

For the division's control, this budget is broken down in complete detail to show the description of material, quantity, and amount of money involved for each activity for each month of the year. These detailed budgets are given to the responsible superintendents for their guidance in ordering materials and supplies.

To procure these materials and supplies it is necessary that the superintendents fill out a form which is submitted to the division's accounting section. If this request conforms to the operating budget, a requisition form is made out in triplicate, which requires the approval signatures of the Commissioner, Director, Auditor, Budget Control Officer, and City Manager. If the amount of the requisition is over \$500 it further requires the approval of the City Council. Upon receipt of an approved requisition the Purchasing Division proceeds to purchase the goods as prescribed by law.

In the case of large quantities of materials and supplies, particularly those used by several divisions, a price-determining contract is awarded by the Purchasing Division, against which purchase orders are written upon receipt of properly approved requisitions.

Our purchases are generally so arranged as to maintain ample stock on hand for operations for a month or two. The exception to this is special supplies or parts such as sweeper belts, valves, special hose, etc. Other parts that are readily obtainable are stocked at a minimum. All of the stock is in charge of a stock-keeper. No releases from this stock-room are permitted without a properly signed requisition, which in turn is submitted to the accounting section for proper recording.

Gasoline is dispensed to equipment by the division's own gasoline pump, which is served by an underground tank of 800 gallons capacity. A signed receipt is obtained from each operator of equipment for all gasoline, oil, etc., received. This receipt form shows the date, license and equipment number, speedometer readings, daily mileage, and amount and description of items received. This receipt is immediately forwarded to the accounting section for recording. At the end of the day's operation the gross dispensed amount of gasoline is read from the meter on the pump, which provides a check against the daily amount used. The gross metered amount can only be read by the accounting section as it is sealed from the view of the pump operators.

### Personnel

The operators of equipment, like all other city employees, enjoy full civil service rights and privileges, which includes seniority, vacation, sick leave, and leave for service injuries. A candidate for appointment as operator must demonstrate to the satisfaction of the division head or superintendent that he is fully capable of the operation and care of the equipment by actual test. After such a test the appointment is probationary for six months. At the end of that period,

(Continued on page 40)



Pouring the loading platform.

## Equipment for Speed and Profit in Airport Construction

By JOS. C. COYLE

**Equipment used in clearing and grading a 600-acre airport and in paving runways, taxiway and loading platform.**

IN JUNE, 1941, one of the crews of the R. C. Tanner Construction Company, of Phoenix, Ariz., finished grading three runways at the new Yuma Aviation Field and paving one of them 4,000 ft. long. This was a month ahead of schedule. To fill in time and keep their equipment occupied until more money became available for this work, they carried out a highway contract at Mohawk, forty miles to the east. Then they returned to the Yuma airport to pave another runway, a taxiway and a concrete loading platform. There remains as yet unpaved a runway 4,950 ft. long. All three runways are 500 ft. wide, including a 150-ft. paved lane in the middle of the east-west and north-south runs. The field is being equipped under another contract with all necessary lighting and wind-recording equipment.

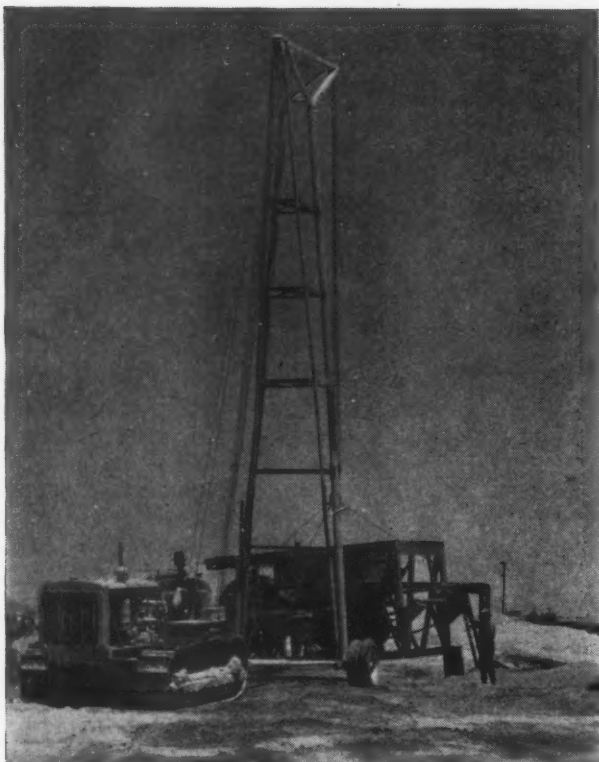


Leveling and finishing with a Barber-Greene spreader machine.

The field was cleared of brush under the first contract, using bulldozer-equipped tractors and carryalls and Wooldridge scrapers on the runway areas, and a large railroad-steel drag with wood fenders attached and pulled by a T-D-18 International tractor to push the brush aside on the remainder of the 600-acre field. In the principal excavation (amounting to 180,000 cubic yards) which was included under that contract, LeTourneau Carryalls and Tournapulls and Wooldridge scrapers were used to move the dirt from cuts to fills. One tractor was used as pusher in the cuts, which reached a maximum depth of about six feet. Cuts and fills were watered with a 1500-gallon Chevrolet tank truck, to secure compaction and lay dust.

The present job included 36,000 cubic yards of excavation, which was made with two 20 yd. and 13-yd. LeTourneau Carryalls, pulled by R-D-8 Caterpillar tractors. Thirteen inches was removed from a 150 ft. strip in the middle of runway No. 3 and the grade leveled with a No. 11 Auto patrol and a Thomas land-leveling scraper, pulled by a D-6 Caterpillar tractor. After watering the subgrade, it was rolled with an 8-ton Galion tandem roller, before applying the 9-inch base course of 2½-inch maximum rock, hauled twelve miles in twenty-two dump trucks, mostly 5-yard Internationals and Chevrolets. About 46,000 tons of rock were required on the entire job. Loads were weighed on a Howe platform scale near the job.





Picking up bottom section of hot plant.

At the rock pit a Lorain-40  $\frac{3}{8}$ -yard shovel was used to load two V-8 trucks, which hauled to the Austin-Western portable rock plant, driven by a Caterpillar engine. A D-8 tractor was used to round up material to the hopper; at one time keeping the plant going while the shovel was undergoing repairs, by shoving material from the pit to the hopper. Screened material was stored in 21-cu. yd. loading bins for loading trucks. Mineral aggregate for the oil surface mixture was hauled from the plant and stored in a stock pile at the hot plant on the job.

The base rock was leveled with the patrol unit and rolled with the 8-ton tandem roller, after having been watered with a 2,200-gallon International tank truck hauling from a tank specially erected at the county airport hangar nearby. Oil for the surfacing was hauled from the railroad tank cars in a 1,085-gallon tank truck, using a trailer-type Viking pump for transfer. The material was mixed at about 275° F. Hauled from the plant with four dump trucks, it was laid down with a Barber-Greene spreader machine. A tack coat of 0.27 gallon of S.C.2 road oil was first sprayed on the base, using a Littleford distributor. Then 2½ inches of hot mix, using 1½-inch maximum rock and S.C.2 oil, processed at about 275° F, was laid down, followed later by a 1½-inch course of 1-inch maximum aggregate, mixed with S.C.6 oil. A tack coat of about 0.1 gallon of S.C.2 oil was used between the two layers of oil cake on this runway. The seal coat was applied using 0.3 gallon of M.C.4 oil and 10 to 15 pounds of chat, per square yard. Each layer of oil cake was rolled with the 8-ton Galion tandem roller.

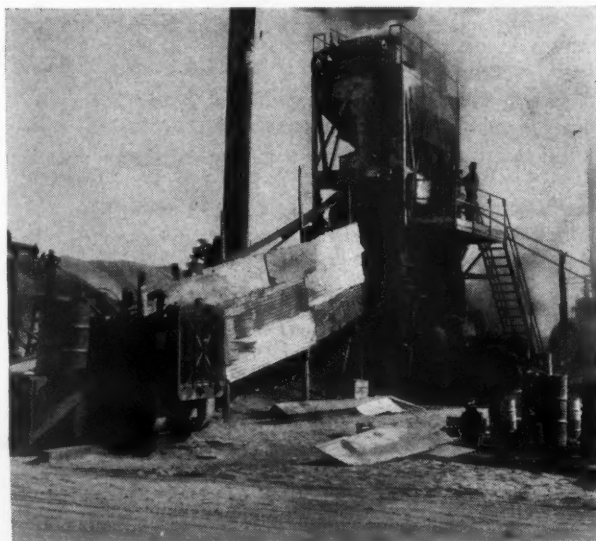
A taxiway 50 feet wide and 4,200 feet long, paralleling runway No. 1 and connected with it by four paved lanes the same width, was constructed in the same way. Oil mix for the entire job totaled 19,000 tons; seal coat 93,000 square yards. Storm drains were installed under the pavement, using 870 feet of 8, 12, and 24 inch corrugated pipe (mostly 24").

At the north end of the field, where hangars are to be constructed later, a 200 by 400-foot concrete loading platform containing 1,600 cubic yards was constructed, using aggregates hauled in four Ford trucks from a commercial pit several miles away. The base course, of the same material used under the runways, is 4 inches thick, watered and then compacted with the 8-ton roller. Concrete was poured in slabs 12½ feet wide, running lengthwise of the area, and 6 inches thick at the middle and 9 inches at the joints. This, known as the Maricopa joint, was employed in preference to installing dowels in these longitudinal construction joints as it speeded up the work and was considered a better type of construction.

After the first strip had been poured through the middle, steel paving forms were set up for strips on each side of it. The base of each side strip was then leveled up with a specially constructed fine grader, pulled by a D-6 Cat or the patrol unit. This grader consists of a steel blade with each end sloping down on the edge to form the joint, and adjustable by a vertical screw bar and wheel. It is mounted in a steel frame 4 feet wide and moving on four 6" x 12" rollers, one pair of which travel along the form and the other pair on wood strips laid on the edge of the slab laid previously. Shovelers add or remove a small amount of material, as required.

The sloping trenches at each edge are then compacted with hand tampers and the remainder of the graded strips with the power roller, and the edge of the previous strip is sprayed with black asphaltic paint from a Hudson hand spray gun. Twelve  $\frac{3}{4}$  x 18 inch dowels are placed for each dummy joint, which are spaced 15 feet apart. Construction joints, with a  $\frac{3}{4}$  x 8 inch fiber insert, are spaced 90 feet, transversely of each strip. When the concrete has set, bituminous filler from a wheelbarrow-type heater is run in the surface of the joints with a cone-shaped hand tank holding about 2 gallons, the metal strips having been removed from the dummy joints.

While the Maricopa joints permitted use of the fine grader, thus speeding preparation of the grade, the methods of pouring expedited the placing of concrete. Aggregates were stock piled adjacent to the east end of the operation and moved to the 14-S Rex paver in rubber tired wheelbarrows, weighed en-route  
(Continued on page 35)



This hot plant jumps from job to job, handled in erection by the special hoist boom shown above.



## **READY for Any Emergency!**

THE Franklin, New Hampshire, pumping station is ready for any emergency. Should water be low in the river, or should the water wheel or the veteran triplex pump fail, a motor-driven, 4" double-suction Fairbanks-Morse Centrifugal Pump stands ready to serve. And should electric power fail, a 65-hp. F-M Gasoline Engine is there to pick up the load.

Franklin's F-M dual-drive pumping unit was installed merely as a stand-by. But it soon proved able to compete in economy with the water-

● The compact, well-integrated, Fairbanks-Morse dual-drive pumping unit which has given outstanding performance in competition with water power in the Franklin, New Hampshire, pumping station.

powered pump. So more and more of the work was shifted to it. That, in the nation's water-power stronghold, is a significant tribute!

Significant, too, is the fact that pump, motor, and engine are all made by Fairbanks-Morse. This gives Franklin taxpayers the protection of undivided responsibility for the performance of their pumping unit.

Whatever the nature and scope of *your* pumping problem, the complete F-M line includes just the pumps to serve you with outstanding economy and dependability. Our engineers are at your call, without cost or obligation. Write Fairbanks, Morse & Co., Dept. D67, 600 S. Michigan Ave., Chicago, Ill. Branches and service stations throughout the United States and Canada.

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Courtesy U. S. Bureau of Reclamation

Clearing reservoir area above dam. Merchantable timber was hauled to central piles and stacked for transportation to mills.

## Clearing the Grand Coulee Reservoir

**Clearing wooded land for a reservoir 151 miles long, covering 82,000 acres—the longest man-made lake in the country, holding ten million acre-feet of water.**

**T**HE clearing of 54,000 acres of rugged and timbered terrain for Grand Coulee reservoir, one of the largest land clearing operations ever undertaken by the Works Projects Administration, is now virtually complete. Sponsored by the Bureau of Reclamation of the Interior Department, this project employed approximately 3,000 men at its peak in a clearing task which, while less spectacular than the construction of the dam proper, was absolutely essential. The work required 2½ years to carry out and involved the expenditure of \$4,900,000 in labor costs. To assure a reservoir free from floating debris that might injure the dam or its machinery or interfere with navigation, it was necessary to clear the canyons and valleys of four rivers, the Columbia and its tributaries—the Sanpoil, the Kettle and the Spokane.

When the waters reach their ultimate height, the reservoir will form a lake 151 miles long, reaching from Grand Coulee Dam in the State of Washington to the Canadian border. Gates of the dam were closed this spring, and already the water has backed up 140 miles and has reached a height sufficient to permit operation of the generators.

The lake will have a surface area of about 82,000 acres. Its 151-mile length makes it the longest man-made lake in the country. The width will vary from 2,000 feet in the canyons to four miles at the widest point. The maximum depth will be 375 feet. When completely full, the reservoir will hold 10,000,000 acre-feet of water.

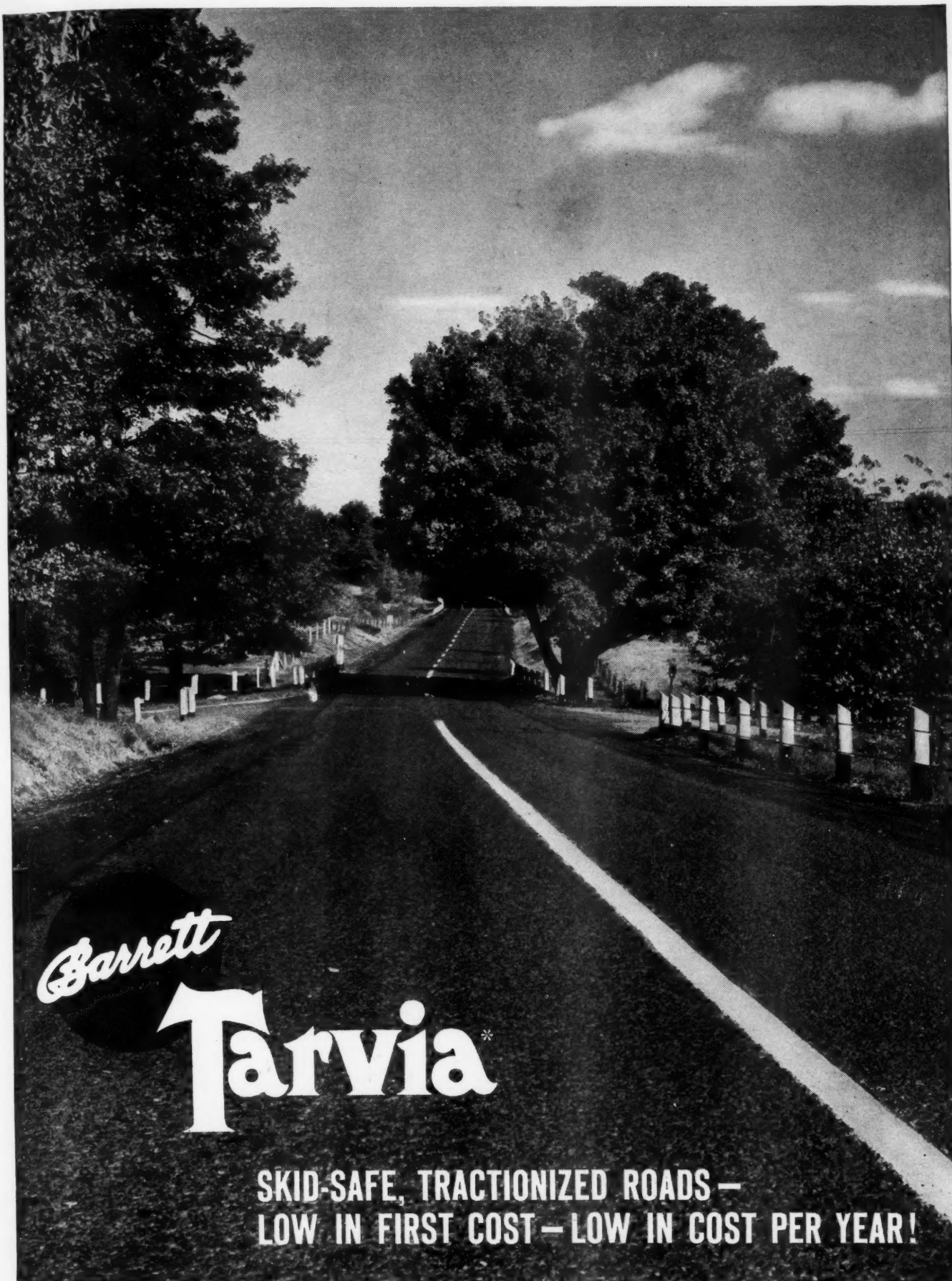
A large-scale housing and feeding program was necessary to supply the army of men engaged in this clearing operation. Seven ground camps were erected to house them; and a floating camp, housing 130 men, was used to get at places inaccessible from the ground. Camps Lincoln, Gerome, Clifford, and Keller were semi-permanent wooden barrack camps. Each barrack was 130 by 20 feet, housing 40 men. Camp Spokane, Detillion and Little Falls were tent camps of 200 men each. Camp Ferry, the floating camp, was built on three barges, each 64 by 24 feet. Double decked superstructures, with sleeping rooms, were erected on two of them, and the third housed the kitchen, mess hall and shower rooms. A smaller barge carried the machine and tool rooms.

Seven refrigerator plants, two ice machines and seven lighting plants were in use at the camps. This equipment will be reconditioned at the end of the clearing period and returned to the Bureau.

The clearing crews used twenty-one boats, all but one of which were built on the project. Largest of these was the "Paul Bunyan," 65 feet long, with a 20-foot beam and a four-foot draft. It was powered by twin Diesel motors of 125 H.P., had a capacity of 100 tons and could carry 300 men. It was used for towing Camp Ferry from place to place and for transporting heavy equipment wherever it is needed.

Prior to clearing operations, a surveying party ran the contour lines of the lake and marked the flow line. Clearing crews followed these lines removing





*Barrett*  
**Tarvia**\*

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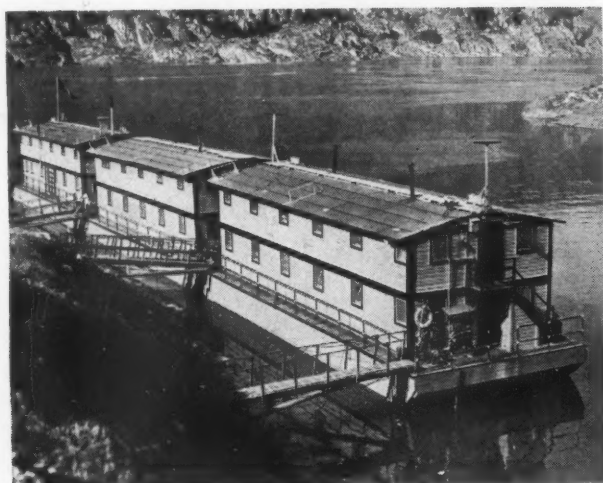
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Piling timber and slash.



"Camp Ferry." Three floating barges on which are quartered the WPA men who are clearing the land.



Workers returning to camp from the "Paul Bunyan." The trail up which the men are walking will be completely submerged.

from the area to be submerged everything that would interfere with either navigation or operation of the dam and everything above the water line that might fall into the lake.

In addition to the Columbia river, Grand Coulee Dam has backed up the Spokane river for 35 miles, and the Sanpoil and the Kettle rivers for eight miles.

About 100,000 acres of land were negotiated for

and purchased by the Bureau of Reclamation. Title to all land in the reservoir area, up to 1,310 feet above sea level now rests with the Bureau. Not only was the land purchased, but the possessions of some three thousand persons, including whole villages, who lived on the site of the lake were either purchased or moved to higher ground. Railroad tracks and highways were relocated; bridges were removed and replaced with others out of reach of the water. Churches, schools, fences, utilities and barns were moved, if possible. If not, they were turned over to the WPA for demolition, and with trees, roots and underbrush, were burned. Five hundred farm homes were abandoned; numerous orchards were cut down, including one peach orchard of 12,000 acres at Kettle Falls.

Several villages were uprooted from their sites along the four rivers, the movable possessions moved elsewhere, and the sites leveled. Boyds, a village 117 miles above the dam, has been moved to nearby benchland, the former site now being under 30 feet of water. Marcus, largest of the villages affected, with a population of 600, is now on a high flat. Kettle Falls was moved to higher ground at Meyer Falls, four and a half miles away. Buildings at Daisy and Clifford were razed and the town moved to a hill; water 75 feet deep covers their former site. Inchelium has been moved two miles away, as has been Jerome. Their sites are now under 100 feet of water.

Considerable heavy land-clearing equipment was utilized on this project, supplied by the Bureau of Reclamation, sponsor of WPA operations. Included were 70 and 90 H.P. tractors equipped with bulldozer blades, logging equipment and double drum hoists. Heavy equipment was essential not only for clearing operations, but also for the construction of access roads to clearing areas, so that trucks could transport men, equipment and salvageable materials. The construction of these roads through this rough terrain was by itself an engineering task of large proportions.

More than 32 million board feet of salable timber has been cut out of the basin, trimmed, and skidded to the river, where it was floated to the dam, and sold to the highest bidder.

Only two of the camps and about 500 men remain to clean up the work. They are engaged in bringing out the last of the timber in the higher areas, and in grubbing out the last of the roots and stumps. Camp Ferry is moving up and down the lake, watching for slides and keeping the booms free of debris.

### Maintaining 750 Miles of Road and Building 50 Miles of New Road

(Continued from page 16)

The county's cost on this project was \$10,330.76, which paid for all equipment rental (except trucks for hauling rock), salary of operators, dynamite, form lumber, transportation of workers, and concrete tile. All labor, cement, sand, steel, and truck rental was paid by WPA.

This record of accomplishments has made it evident that personnel and management policies are as important to a county highway department as actual construction procedure. With competent, non-political and enthusiastic employees, who are constantly striving for better unit costs, concrete results are bound to follow.

NOTE: Since writing this article Mr. Wardrip has become County Engineer of Neosho Co.



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## DEODORIZING AND DECOLORIZING COAGULANT

Activated Blackalum is an outstanding premium coagulant at \$2.00 more per ton. It won't allow sludge to ferment in the basins. It is fast floccing over wide pH range. It is for the superintendent who will pay a little more to get complete satisfaction from winter coagulation worries.



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## ECONOMICAL . . . CONTAINS HIGH ALUMINA

Standard Activated Alum is one of America's largest selling coagulants. It is the type preferred by the alert superintendent who wants maximum coagulation economy with greatest efficiency.

## AMERICA'S MOST POPULAR WATER WORKS COAGULANTS USED BY THE BIGGEST NAMES IN WATER WORKS PRACTICE

### *Palmer Filter Bed Agitators Chosen*

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at NEWPORT NEWS and at hundreds of other municipal water works as well as most of the duPont plants, among many other industrial plants.

### *Other Worthwhile Water Works Products:*

CHAMPION POWDERED ACTIVATED CARBON

BLEACHING CLAY

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FILTER SAND

*You get the good things first from*





# The WAR EMERGENCY AS IT AFFECTS PUBLIC WORKS

## Chlorine Priorities

The War Production Board has published the following order, which has already taken effect:

Users of Chlorine or Chlorine products for *potable water treatment* and *sewage treatment* need no longer file with their suppliers Form PD-190, but are required instead to file a certificate to the effect that the Chlorine or Chlorine products so received will be used only for such purposes.

Preference rating A-2 is assigned to chlorine to be used for treating potable water and sewage. Treatment of industrial water is given A-10 rating; public and industrial swimming pool sanitation, A-6.

Chlorine for purposes other than water or sewage treatment can be obtained only by order of the Director of Industrial Operations.

## A.W.W.A. on Wartime Chlorination

The Board of Directors of the American Water Works Association at its annual meeting adopted a resolution that the Board "express its disapproval of a general requirement that chlorine residuals be carried throughout the water distribution systems," stating that "Experience here and abroad does not indicate that such a general requirement is practicable under many conditions, nor necessary."

In the case, however, of communities housing defense industries or military encampments, the following measures should be taken in addition to the usual safeguards:

"1. Chlorination of surface water supplies, except where the existing safeguards and historical records of the plant warrant the omission of such treatment.

"2. Chlorination of ground water sources when local conditions indicate the necessity for so doing.

"3. Provision of standby chlorinating equipment as a safeguard against interruption of treatment.

"4. Where chlorination is practiced, maintenance of such chlorine residuals at the point of treatment as are indicated by experience to be adequate, and the making of frequent chlorine residual tests at the point of treatment.

"5. Provision made for local disinfection in distribution systems when breaks occur or where special hazards exist."

## Check List of Waterworks and Sewerage Supplies

A report of the Sanitary and Public Health Engineering Division of the National Committee on Civilian Protection in War Time of the American Society of Civil Engineers, which covers protection of water works, sewerage works, refuse disposal and other facilities in 30 pages of the January "Proceedings," includes lists of emergency supplies for making re-

## A NEW FEATURE WHICH WILL APPEAR IN EACH ISSUE OF PUBLIC WORKS

pairs which should be kept on hand carefully stored. The list for water works is as follows:

Trucks	Dynamite, blasting caps, and fuses, where rock may be encountered
Cleaning rods and equipment	Picks
Chlorinating supplies	Bars
Portable power pumps with suction and discharge hose	Trowels
Portable hand pumps	Hoes
Portable lights	Axes
Wooden and perhaps steel sheeting and other lumber	Drills, hammers, mauls
Trench jacks and braces	Rope with hook attached
Paving breakers	Scrapers
Gasoline engine driven compressors	Saws
Valves	Derricks
Rubber boots, coats, hats, and gloves	Chain and falls
Hardware, including nails, bolts, and nuts	Pipe and fittings
Valve boxes	Pails
Sand bags	Lanterns and batteries
Brick, cement, sand and gravel	Canvas
Warning signs	Wheelbarrows
Pipe cleaning equipment	Rope
Shovels	Wire cable
	Chains
	Grease, oil, gasoline and kerosene

Also, spare parts for pumping plants—valves, pipes, fittings, pumps, motors, transformers, couplings and sleeves; chlorinating equipment (stored at a distance from the treatment plant); mechanical joint split sleeves, adapter sleeves, test plugs.

For sewage treatment plants, the following are listed:

- Spare cutters, both fixed and moving, for comminutors and shredders
- Spare links, flights, wearing shoes, and pins for sludge removal equipment
- Shear pins
- A set of brushes for fine screens
- Nozzles for trickling filters
- Diffuser plates and bolts for aeration tanks
- Ball valves for sludge pumps
- Fusible plugs for flame traps
- For chlorinating equipment: Gaskets, packing, lead washers, pressure-reducing inlet valves, bell jar, head tube, valves and flexible connections for feed lines, reducing valve union assembly.
- Valve channels and springs for vacuum pumps
- Belts for Reeves drives
- Cloths for vacuum filters
- Packing, lubricants, laboratory equipment, etc.

For repairing sewers; concrete or steel pipe in several sizes; lumber for a box conduit, and lumber and braces for sheeting; well points and pumps; portable pumps for dewatering craters and basements; chloride of lime for disinfecting.

## Air Raids—What NOT to Do

Uninformed defense officials have made recommendations for measures to be taken in case of air raids that have been severely criticized by the Westchester County, New York, Defense Council. Typical was the recommendation that every householder fill



# A WAR MESSAGE

to

# ALL EMPLOYERS

★ From the United States Treasury Department ★

WINNING THIS WAR is going to take the mightiest effort America has ever made—in men, in materials, and in money! Every dollar, every dime that is not urgently needed for the civilian necessities of food, clothing, and shelter, must, if we are to secure final Victory, be put into the war effort.

An important part of the billions required to produce the planes, tanks, ships, and guns our Army and Navy need must come from the sale of Defense Bonds. Only by regular, week by week, pay-day by pay-day investment of the American people can this be done.

This is the American way to win. This is the way to preserve our democratic way of life.

Facing these facts, your Government needs, urgently, your cooperation with your employees in *immediately* enrolling them in a

## PAY-ROLL SAVINGS PLAN

The Pay-Roll Savings Plan is simple and efficient. It provides, simply, for regular purchases by your employees of United States Defense Bonds through systematic—yet voluntary—pay-roll allotments. All you do is hold the total funds collected from these pay-roll allotments in a separate account and deliver a Defense Bond to the employee each time his allotments accumulate to an amount sufficient to purchase a Bond.

The Pay-Roll Savings Plan has the approval of the American Federation of Labor, the Congress for Industrial Organization, and the Railroad Brotherhoods. It is now in effect in several thousand companies varying in number of employees from 3 to over 10,000.

In sending the coupon below, you are under no obligation, other than your own interest in the future of your country, to install the Plan after you have given it your

consideration. You will receive—1, a booklet describing how the Plan works; 2, samples of free literature furnished to companies installing the Plan; 3, a sample employee Pay-Roll Savings authorization card; and 4, the name of your State Defense Bond administrator who can supply experienced aid in setting up the Plan.

To get full facts, send the coupon below—today! Or write, Treasury Department, Section B, 709 Twelfth St., NW., Washington, D. C.

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- 1 It provides immediate cash now to produce the finest, deadliest fighting equipment an Army and Navy ever needed to win.
- 2 It gives every American wage earner the opportunity for financial participation in National Defense.
- 3 By storing up wages, it will reduce the current demand for consumer goods while they are scarce, thus retarding inflation.
- 4 It reduces the percentage of Defense financing that must be placed with banks, thus putting our emergency financing on a sounder basis.
- 5 It builds a reserve buying power for the post-war purchase of civilian goods to keep our factories running after the war.
- 6 It helps your employees provide for their future.

**MAIL THIS COUPON NOW**

Treasury Department, Section B  
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Washington, D. C.

We want to do our part. Please  
rush full information regarding  
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POSITION.....  
COMPANY NAME.....  
ADDRESS.....  
NUMBER OF EMPLOYEES.....



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GPO 16-25943-1 Form No. DSS-BP-2

When you need special information—consult the classified READER'S SERVICE DEPT., pages 55-57

bathtubs and other containers in the event of air raids. This, of course, would result in immediate demands on water systems many times their capacity to deliver, would empty reservoirs and in fact render fire fighters helpless for lack of water, not to mention flooding of the sewers after the raid was over.

The recommendations of the chairman of the State Defense Council regarding methods of testing the adequacy of water distribution systems by opening sixty per cent of all fire hydrants at a given signal were also decried as a further example of lack of even elementary knowledge of the problem of maintenance of water service.

Another foolish item of advice found in a number of official defense recommendations is to turn off the gas at the meter, but on no account turn it on again—after the raid, telephone the gas company to send a man to do this. In a city of 30,000, say 7,000 homes, how long would it take the gas company to receive 7,000 telephone calls and send ten men (say) to turn off 700 meters each? And what kind of language would the 7,000th telephoner be using when he finally gets his connection?

### Examination for Appointment as Assistant Sanitary Engineer (Regular Corps) United States Public Health Service

An examination for appointment as Assistant Sanitary Engineer in the Regular Commissioned Corps of the United States Public Health Service is scheduled to be held at Washington, D. C.; Cincinnati, Ohio; New Orleans, Louisiana; Kansas City, Missouri; and San Francisco, California, 9 A. M. on May 11, 1942.

Candidates must be not less than 23 years nor more than 32 years of age on that date and must have had at least seven years of educational (exclusive of high school) and professional training, or experience equivalent thereto; and shall have graduated from a reputable professional school granting a degree in engineering (sanitary engineering course). In addition the applicant will be required to pass a satisfactory physical, academic and professional examination before a board of commissioned officers of the Regular Corps and will be required to submit to the board a recent photograph of himself, and his diploma from the professional school from which he was graduated, or a certified copy thereof.

The written examination will comprise questions in (1) chemistry; (2) bacteriology and planktology; (3) mathematics; (4) physics; (5) hydraulics; (6) design and construction of sanitary projects; (7) heating, lighting and ventilation; (8) water and sewage treatment; (9) sanitary science and public health; (10) practical problems and laboratory demonstrations. The examination, physical, academic and professional, will require approximately seven days for completion.

Commissioned officers are not appointed to any particular station, but to general service. They are subject to change of station as the exigencies of the Service may require and shall serve wherever assigned to duty.

Compensation, including allowance for quarters and subsistence, will be \$3,158 and \$2,699 for officers with and without dependents, respectively.

Persons desirous of participating in this examination should address their application to the Surgeon General, U. S. Public Health Service, Washington, D. C., in their own handwriting requesting permission to appear before the board of examiners. The applicants should state their age, date and place of birth, present

legal address, and whether a citizen of the United States, and the name of the professional school or college of which they are graduates, and furnish a recent photograph and at least two testimonials as to their professional and moral character. Applicants of foreign birth must furnish proof of United States citizenship. If naturalized, naturalization certificate should be presented with the application. Candidates born in the United States who pass the entire examination will be required to prove citizenship before being offered appointment.

Transportation expenses to and from and cost of maintenance at place of examination must be assumed by the candidate.

### Conference on Wartime Waterworks Problems

The American Water Works Association will hold its annual meeting this year in Chicago, June 21-25, at the Stevens Hotel. It will be designated a "War-time Conference," and the program is being definitely planned on the basis of this title. Advance promotion, which is under the direction of Jos. M. Wafer, Industrial Chemical Sales Division, West Virginia Pulp & Paper Co., 230 Park Ave., New York, N. Y., will be based upon the necessity facing water works men to take counsel with each other in the present wartime emergency.

Says Secretary Harry E. Jordan: "Is such a meeting worthwhile? Let's think about it. When water works men have gathered in their meetings during previous years, they have exchanged ideas about ways of handling their common problems, listened to speakers who had solved special problems and studied new equipment offered for use in the field.

"Is there need for that in 1942? Was there ever a greater number of new situations confronting all water works? 'What can I use instead of what?' 'How can I get it?' 'When?' Were there ever more special problems? Priorities! Bomb Damage! Guarding Property! Were manufacturers ever more active than they are now devising ways to use new materials to fill old as well as new needs?

"Are people interested in such conferences? Do they attend? Have you ever seen water works men sit in a morning session till one o'clock? I have—in 1942. Have you seen them standing around the walls because there were no more chairs to be had while someone talked about water works problems? I have—in 1942.

"Have you seen Americans in deadly earnest, trying to do their part to make America go? Of course—you are seeing it everywhere!

"These are the things that convince me that the A.W.W.A. Conference on Wartime Water Works Problems will be the most useful gathering the Association has ever sponsored. No more accessible location than Chicago and the Stevens Hotel could have been found for these sessions that start on June 21st. Nothing but emergency will keep away from this meeting the water works man who feels his responsibility to his consumers and wants to give them all the service they need for doing their part in this war."

### Conference on Timber Construction

The American Society of Civil Engineers will devote part of the morning session of April 23 of its Spring Meeting at Roanoke, Va., to a discussion of the use of timber as a substitute for steel.



## Revision of Preference Rating P-46

Preference Rating Order P-46, issued last September, has been completely revised, the revision taking effect March 26th. The principal changes affecting public utilities are as follows: An A-2 rating replaces A-10 for "material for maintenance, repair and operating supplies for power plants and pumping plants," and A-5 for lines, pipes and substations.

A-5 is granted for "materials to bring electricity, gas or water to war plants or other projects bearing a rating of A-5 or better. This does not apply to housing projects. An A-5 rating is also granted to deliveries of materials needed to protect power or water plants against sabotage such as fencing, tear gas bombs for guards around such plants, etc. These ratings may not be applied without prior authorization from the Director of Industry Operations of the War Production Board.

"Line extensions to serve a new consumer are restricted to 250 feet. The original order permitted a 1,000-foot extension. Extensions begun prior to March 26, the date of issuance of this order, may be completed.

"Despite this restriction, the Power Branch of the WPB announced that houses that were wired prior to March 26 or for which the foundations were completed by that date, may be served with electricity provided they are not more than 2,000 feet from an existing line and provided the utility specifies that galvanized steel wire will be used instead of copper."

## If You Can Not Get Calcium Hypochlorite

High-test calcium hypochlorite such as "HTH" and "Perchloron" are now extremely scarce because the government has been buying practically the entire supply. Those who have been using these compounds, which come in the dry powdered form, may therefore find it necessary to change to a substitute, probably liquid sodium hypochlorite. The process of disinfection is the same and liquid sodium hypochlorite can be used with the hypochlorinators that are already in use.

In changing over, be sure to allow for the difference in strength so that the same *available* chlorine will be applied as was contained in your regular dose of calcium hypochlorite. Usually the high-test calcium hypochlorites run about 70% available chlorine; liquid sodium hypochlorites about 10% to 15%. When first making the change, check on the result by making frequent tests for chlorine residual. The sodium hypochlorites lose their strength rapidly if exposed to the air, so keep the containers tightly sealed. The solution should be made up for the hypochlorinator to 1% strength; otherwise it will lose its strength rapidly.

## Wanted—a Substitute for Bass Fibre for Street Brooms

There is a shortage of African bass fibre, used for refilling street cleaning brooms. A satisfactory substitute is being sought, and the American Public Works Association has queried a number of sources to learn what users and suppliers of broom materials have to suggest.

A manufacturer of mechanical sweepers reports

that split hickory (in various widths) is being furnished almost entirely because of the practically complete failure of the supply of bass fibre and split bamboo.

Detroit finds neither split bamboo nor split hickory entirely satisfactory; the former is preferred but both soften quickly and lose resiliency.

Washington is considering "tampico," "palmetto" and "palmyra" fibres, available from South America; also synthetics, such as nylon mono-filaments, the applicability of which is questionable.

Newark, N. J., is using bamboo. Cincinnati uses thin split hickory. Milwaukee expects to use split bamboo if nothing better is found.

New York says: "At the present time it is possible to obtain Cape Mount bass, Grand bass, Marshall bass and blended bass. . . . The above are not as durable as Prime Sherbro bass formerly used. A comprehensive survey of potential substitutes for these brooms of synthetic fibres was made. The result was highly unsatisfactory." (Albert Pleydell, Commissioner of Purchases.)

## Equipment for Speed and Profit in Airport Construction

(Continued from page 26)

on two Winslow Junior platform scales. The paver itself was mounted on the flat bed of an International truck, so as to be easily moved from slab to slab, and at the same time provide elevation for gravity discharge into the two rubber tired buggies used to roll the mix to the forms.

Two long wooden floats with plow handles at each end were used in consolidating the pours, followed by finishers with lighter hand tools. A D-6 tractor with La Plant-Choate bulldozers kept the aggregate piles rounded up, and between times pulled a Thomas scraper in fine grading various parts of the adjacent runways and grounds. This scraper, developed by a local contractor-manufacturer, is especially suited to fast and accurate land leveling. It has hydraulic control and is usually pulled by light, fast tractors.

The hot plant was moved away to another job after the first airport contract then back again for the present job, but taking it down and putting it together again is a short operation for the Tanner crew. A caterpillar tractor does the hard lifting by means of a specially constructed hoist boom, mounted on two rubber tired wheels, with a strong box-welded axle to which the base of the boom is hinged. The boom itself is 47 feet long, made of 8" and 6" pipes with some cross braces of angle steel, joined together by welding. The cross frame for the hoist sheaves at the top has an overhang of 12 feet, to provide clearance for handling large pieces of machinery. In order to provide leverage for carrying as well as lifting, without tipping the tractor, a ten-foot tongue is attached to the boom axle, made of 8 inch pipe, strengthened by welding a 1 x 6 inch fin of steel to the bottom, and a reversed angle to pipe and fin on each side.

R. A. Floyd, of the United States Engineering Department, is in charge of construction for the government, assisted by Leo Frost as inspector of asphalt and Charles O'Leary inspector of concrete construction. C. L. Turner is construction superintendent of the present job for the contractors, and M. J. Tanner is time keeper and purchasing agent.

## Specifications for Bituminous Surfaces for Highways and Airports

(Continued from page 20)

*e. Preparation of Base and Salvaged Aggregate.*—(Case 3). When material in the existing road surface is to be used for mixing without the addition of new material, the surface shall first be scarified lightly and bladed to uniform grade and to the cross section shown on the plans. The reshaped surface shall then be scarified again to such depth as is ordered by the engineer and in such manner as to leave a foundation stratum of undisturbed material parallel, both in profile and cross section, to the proposed finished surface. The loosened material shall be bladed aside and the undisturbed under-stratum rolled, or watered and rolled, as directed. The material bladed aside shall be formed into a windrow at the side of the road. If shown on the plans and called for in the bid schedule, a prime coat shall be applied to the undisturbed stratum as described under Section D.

*f. Windrowing and Sampling.*—Care shall be exercised to prevent the aggregate, whether new, blended, or salvaged, from becoming mixed with earth or shoulder material. Windrows of aggregate shall be shaped uniformly and trimmed so that accurate measurements of volume may be taken by the engineer. The uniform windrows shall be left undisturbed until measuring and sampling are completed. At least one day shall be allowed for measuring and sampling each run.

*g. Dry Aggregate on the Road.*—Immediately prior to the application of bitumen, the aggregate to be treated shall be tested for moisture. If the moisture content is more than 2 percent of the dry weight of aggregate, the aggregate shall be turned by blades or disk harrows, or otherwise aerated, until the moisture content is reduced to 2 percent or less. The prepared aggregate shall then be spread smoothly and uniformly over half the road or other convenient width of surface ready for the application of bituminous material.

*h. Application and Partial Mixing.*—The bituminous material shall be distributed uniformly in 3 applications, each of approximately one-third of the total required amount as determined by the engineer. It shall be applied uniformly at the temperature prescribed in the specifications. Immediately behind the distributor shall follow an assemblage of double disk or other harrows or equivalent equipment, partially to mix the aggregate and bituminous material and to leave as little free bituminous material as possible. The intervals between applications shall be as ordered by the engineer.

During all applications, the surfaces of adjacent structures and trees shall be protected in such manner as to prevent their being spattered or marred. Bituminous material shall not be discharged into borrow pits or gutters.

*i. Mixing.*—After the last application and partial mixing, the entire mass of bituminized aggregate shall be windrowed near the center of the road and then mixed by the assemblage of mixing units specified, by blading the treated material from side to side of the road, or by manipulations producing equivalent results until all particles are coated with the bituminous material and the whole mass has a uniform color. During the mixing, care shall be taken to avoid cutting into the underlying base or contaminating the bituminous mixture with earth or other extraneous matter. When so directed, the mixing process shall be confined to part

of the width or area of the road so as to allow a convenient passage for traffic.

Before it is spread, the windrowed mixture shall be examined by the engineer who shall determine whether the mixing is complete, the bituminous content correct, and the moisture removal satisfactory. Should the mixture show an excess, deficiency, or uneven distribution of bituminous material, the unsatisfactory condition shall be corrected by the addition of the required aggregate or bituminous material, and by remixing. If the moisture content exceeds 2 percent of the dry weight of aggregate, the contractor shall blade and reblade the material and allow it to dry out. If necessary, the material shall be harrowed or disked and all compressed masses of material broken up. No spreading shall be done, except when authorized in writing by the engineer.

At the end of each day's work, or when work is interrupted by weather conditions, all loose material shall be bladed into a windrow, whether the mixing is complete or not. It shall not be allowed to remain spread on the road over night.

*j. Procedure with Thickened Edge.*—If required by the approved typical section, provision shall be made for a thickened edge of the surfacing. A triangular cut shall be made with a blade grader at each edge of the road. In making the cut, the excavated material shall be thrown to the shoulder in a small windrow against which the bituminized material shall be spread.

*k. Laying, Compacting, and Finishing.* — (1) Spreading and Blade Finishing.—After the mixing has been completed, the mixed material shall be spread from the windrow, to the required width by a self-powered, pneumatic-tired blade grader. After approximately one-half of the material has been laid, the remaining material shall be windrowed and that already laid shall be rolled once and then planed with the blade grader to remove inequalities. The remaining material shall then be spread. During compaction, the surface shall be dragged or bladed as necessary to fill any ruts and to remove incipient corrugations, waves, or other irregularities. The intervals between placing successive layers shall be as directed by the engineer. In spreading from the windrow, care shall be taken to prevent cutting into the underlying base. If necessary to prevent such cutting, a layer of the mixture approximately one-half inch thick shall be left at the bottom of the windrow.

(2) Rolling Finished Surface.—After all layers have been placed, the surface shall be rolled. Rolling shall be longitudinal and shall commence at the outer edges of the road, overlapping the shoulders, and progress toward the center, except that on super-elevated curves, rolling may progress from the lower to the upper edge. Blading shall continue during the rolling only if so ordered by the engineer. Rolling shall continue until the surfacing is of uniform texture and degree of compaction, and is true to grade and cross section. Under no circumstances shall the center of the surface course be rolled first.

(3) Shaping Edges.—While the surface is being compacted and finished, the contractor shall trim the edges neatly to line.

*l. Improving Unsatisfactory Areas.*—If, at any time after the engineer has authorized spreading of the mixture, unsatisfactory areas develop that require additional bituminous material, additional aggregate, or additional road mixing and consequent relaying, re-



compacting, and refinishing, the work shall be done by the contractor when ordered in writing by the engineer.

*m. Seal Coat.*—If shown on the plans and called for in the bid schedule, a seal coat of the type called for shall be applied to the finished road-mixed surface. The surface shall be open to traffic for at least 2 weeks before the seal coat is applied.

*n. Stockpiling.*—When indicated on the plans, road-mixed aggregate shall be stockpiled in the amounts and at the locations so indicated. Stockpiles shall be shaped as directed by the engineer. Material for stockpiling shall be obtained by shoveling from the completely mixed windrow just prior to its being laid, shovelfuls of material being taken one at a time at such intervals as will produce the required quantity. Stockpile sites shall be cleared, cleaned, and leveled by the contractor.

*4. Method of Measurement.*—*a.* The unit of measurement for surfacing laid shall be the mile or the square yard, whichever is called for in the bid schedule. The mileage or yardage to be paid for shall be the number of miles (measured horizontally along the center line of the road) or square yards of surfacing completed to the width shown on the plans and accepted. When measurement is by the mile, no additional allowance shall be made for required widening on curves and at intersections.

When the engineer orders in writing the reworking and refinishing of unsatisfactory portions of previously approved surface, as provided under *l* above, the lengths in miles or the area in square yards of such portions, as the case may be, shall be measured by the

engineer and added to the mileage or yardage that would have been paid for had no reworking and refinishing been ordered in writing.

*b.* The yardage or tonnage to be paid for shall be the number of cubic yards or tons of new or additional aggregate, including all filler, used in the accepted work or placed in authorized stockpiles. When the bid schedule calls for payment by the cubic yard, measurement shall be made in the vehicles at the point of delivery.

*c.* The unit of measurement for bituminous material shall be the gallon or the ton, whichever is called for in the bid schedule. The gallonage or tonnage to be paid for shall be the number of gallons or tons of bituminous material used as ordered in the accepted work. Gallonage shall be determined by measuring the material at a temperature of 60° F., or by converting the gallonage measured at other temperatures to gallonage at 60° F., in accordance with A.S.T.M. Designation D 206-36.

*5. Basis of Payment.*—The quantities of surfacing mixture and of materials, determined as provided in Par. 4 above, shall be paid for at the contract unit price per mile or per square yard as the case may be, which prices and payments shall constitute full compensation for preparing base or subgrade, for furnishing, handling, mixing, manipulating, and placing all materials, for all shaping, compacting, and rolling, for finishing, for improving unsatisfactory areas, for reconditioning subgrade, shoulders and gutters, for stockpiling road-mixed aggregate, for cleaning up pits and quarries, for clearing, cleaning, and leveling stockpile sites, for furnishing and sealing of scales, for

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furnishing the weigh house, for facilitating and controlling traffic and for all labor, equipment, tools, and incidentals necessary to complete the item, except any prime coat or seal coat. When the bid schedule contains an estimated quantity for "Watering of Surface Course," any authorized watering shall be paid for as provided under *Watering*.

### Asphaltic Limestone, Hot Mix

This pavement consists of a wearing course composed of a compact layer of asphaltic limestone mixed hot with asphalt cement, constructed on a prepared base course. Following are the specifications for this pavement of the Alabama Asphaltic Limestone Company.

#### Materials

**Asphaltic Limestone**—The rock asphalt shall be uniform natural asphaltic limestone consisting of not less than four (4) per cent of asphalt nor more than ninety-six (96) per cent of limestone practically free from sulphates, alumina, and any but minute shells. It shall be so crushed that the pulverized material will meet the following gradation requirements:

Passing 200-mesh sieve.....	4% to 11%
Passing 10-mesh sieve.....	50% to 68%
Passing $\frac{3}{8}$ -inch screen.....	98% to 100%

The asphaltic limestone shall be the product of a quarry and plant that has previously produced material meeting these requirements which has been successfully used for a period of not less than 3 years.

**Asphalt Flux**—The asphalt flux to be incorporated with the asphaltic limestone shall be homogeneous, free from water and shall meet the following requirements:

Specific gravity 25°C/25°C....	Not less than 1.000
Total bitumen soluble in CCl <sub>4</sub> ..	Not less than 99.5%
Ductility at 25°C.....	Not less than 100
Loss at 163°C, 5 hours.....	Not more than 1.0%
Penetration, 25°C, 100 gm., 5 sec.....	.85—150
(as determined by the Engineer)	

**Sand**—The sand used in this mixture shall be free from clay, loam and other foreign matter. It shall be so graded that not more than five (5) per cent will pass a 100-mesh sieve; not more than thirty (30) per cent will pass a 50-mesh sieve; and not more than five (5) per cent will be retained on a 4-mesh sieve.

**Mixing**—The asphaltic limestone and sand shall be dried and heated to a temperature of from 250° F. to 350° F. in an approved revolving drier which shall be equipped with a properly functioning pyrometer. Plants equipped to dry rock asphalt and sand separately and weigh the correct amount of sand and rock asphalt in each batch will be required to keep both materials within the allowable temperature range specified in this paragraph.

Arrangements shall be made to by-pass rock asphalt around any screen on the plant having openings smaller than three-quarter ( $\frac{3}{4}$ ) inch.

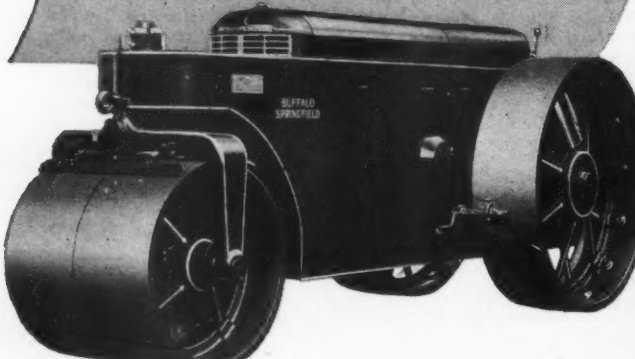

The mineral aggregate in the asphaltic limestone mixture shall contain not less than twenty (20) per cent nor more than thirty (30) per cent of sand.

The asphaltic limestone sand mixture shall be accurately weighed into the pugmill mixer and the asphalt cement, heated to a temperature between 250° F. to 350° F., shall then be weighed and added in sufficient quantity so that the resulting mixture shall contain not less than eight (8) nor more than ten (10) per cent of bitumen as determined by the Engineer. Each batch of pulverized rock asphalt and asphalt cement

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shall be accurately weighed, or measured by approved measuring devices, before being incorporated into the mixture.

**Laying Surface Course Mixture**—The prepared base shall be clean and free from dust or foreign matter before the surface course is spread. The surface course shall not be spread on a wet base or when the air temperature is lower than 40° F. without written approval of the Engineer. If the Engineer so directs, crushed stone, slag, gravel or chert base shall be given a prime coat of bituminous material to take up dust.

The prepared hot asphaltic limestone mixture shall be delivered in trucks—covered if the Engineer so directs—at a temperature of from 250° F to 350° F., and immediately spread into place with hot shovels and raked to such depth that the weight in pounds of material in each square yard of surface course will be not less than one hundred (100), multiplied by the depth in inches shown on the plans. The material shall be dumped on approved dumping boards. All contact joints such as gutters, curbs, manholes, paving, etc., shall be lightly painted with hot asphalt cement or asphalt cutback immediately before spreading the surface course mixture.

The process of uniformly distributing the rock asphalt with rakes shall be so conducted that the prongs of the rakes shall thoroughly and completely loosen any compact material so that the raked surface course shall have a uniform, even density.

Finishing or spreading machines may be used in place of hand spreading and raking. The manner of spreading and the type of forms, if used, and finishing machine must be approved by the Engineer.

**Rolling**—Immediately after being spread the as-

phaltic limestone shall be rolled with a self-propelled roller weighing not less than eight (8) tons. Rolling shall start longitudinally at the sides and proceed towards the center of the roadway, overlapping on successive trips by at least one-half the width of the rear roll. The motion of the roller shall at all times be slow to avoid displacement of the surface mixture. The rolling shall progress continuously at the rate of not more than two hundred (200) square yards per hour per roller and, where practicable, shall include angle and cross rolling. An excess of either water or oil on the rolls will not be permitted.

**Joints in Surface Course**—Placing of the surface course shall be as nearly continuous as possible and the roller shall pass over the unprotected edge of the freshly laid mixture only when the laying of the course is to be discontinued for such length of time as to permit the mixture to become chilled. In all such cases and in the forming of joints, except when a rope joint is used, provision shall be made for a proper bond with the new surface mixture by cutting back the joint to the specified depth and to a vertical edge, which shall be painted with a thin coat of hot asphalt cement. The fresh mixture shall be raked against the joint, thoroughly tamped with hot irons and rolled. Hot smoothing irons may be used to seal joints, but in such cases extreme care shall be exercised to avoid burning the surface.

**Protection of Surface Course**—After the surface course has received its final rolling it shall be protected from traffic until it is cold or in such condition as not to be injured by traffic. If the Engineer so directs, a light coating of fine asphaltic limestone or Portland cement shall be swept over the surface.

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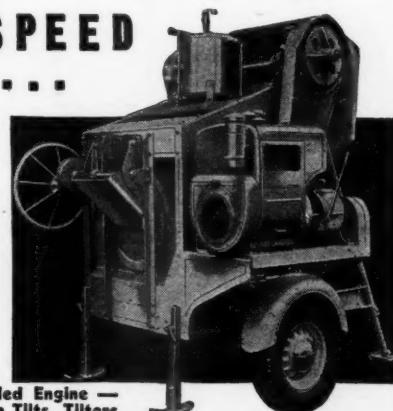
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## Management of Public Works Equipment

(Continued from page 24)

if the employee's services are satisfactory, he may be fully appointed.

### Accounting

All of the various forms, as previously described, are forwarded to the accounting section for recording. A control is kept on each individual piece of equipment daily as to the hours worked, miles traveled, amount of gasoline, oil, grease, tires, repairs, etc. The information is further entered on a large ledger form in complete detail by each month of the year, which provides space for a two-year recording. From the information as shown by this form, we are able to make a detailed analysis and comparison of the various types and makes of equipment in use.

In obtaining the costs on any job, an hourly rate for the particular type of equipment is applied. This rate is based on the hourly cost for the previous year and adjusted to the actual cost at the end of the year. Our experience has been that the variance is never more than one or two cents per hour.

### Public Relations

All employees are instructed that the utmost courtesy be used toward the public. Accidents that our equipment may become involved in must be reported immediately on a special form, which is forwarded to the Legal Department for their information, and for use, in cooperation with the Police Department, in the investigation of the accident. A record is kept on each operator which readily discloses his past history of accidents. By doing so we have a better con-

trol of the operators and impose proper penalties where accidents are frequent.

The above is condensed from a paper by Mr. Anderson before the American Public Works Convention.

## Insuring the City's Sewerage Investment

(Continued from page 18)

which becomes immediately earned by virtue of a loss from date of loss to expiration of the policy figured on the pro-rata basis. It does not necessarily provide an amount of indemnity sufficient to cover the cost of reinstating the policy to its original amount, and must not be reported as providing reinstatement insurance. What it actually does for you is secures that portion of the premium which was reported by a loss which you might sustain for the amount of the loss which no longer maintains your values for the full amount that you originally insured.

The last subject to be brought up is the matter of Contingent Liability so far as contractors are concerned who may be making alterations or repairs, and possibly additions to your present plant. You should secure yourself in knowing that this individual contractor carries public liability and property damage for sufficient limits to secure protection for the city, if named in a suit for an accident for which the contractor may be held liable. This protection can be afforded you by having the contractor supply the city with a certificate of his policy naming the city as joint assured for the time that he is working on your premises.

This material is part of a paper by Mr. Pauly before the 1941 meeting of the Wisconsin Sewerage Works Conference.



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# A STIRRING MESSAGE TO WATERWORKS MEN

Both Engineers and Operators

**T**HE Sixty-second Annual Meeting of the American Water Works Association is not to be a "convention." It will be, instead, a

## CONFERENCE ON WARTIME WATER WORKS PROBLEMS

Is such a meeting worth while? Let's think about it. When water works men have gathered in their meetings during previous years, they have exchanged ideas about ways of handling their common problems, listened to speakers who had solved special problems and studied new equipment offered for use in the field.

Is there need for that in 1942? Was there ever a greater number of new situations confronting *all* water works? "What can I use instead of what?" "How can I get it?" "When?" Were there ever more special problems? Priorities! Bomb Damage! Guarding Property! Were manufacturers ever more active than they are now devising ways to use new materials to fill old as well as new needs?

Are people interested in such conferences? Do they attend? Have you ever seen water works men sit in a morning session till 1 o'clock? I have—in 1942. Have you seen them standing around the walls, because there were no more chairs to be had, while someone talked about water works problems? I have—in 1942.

Have you seen Americans in deadly earnest, trying to do their part to make America go? Of course—you are seeing it everywhere today!

These are some of the things that convince me that the A.W.W.A. "Conference on Wartime Water Works Problems" will be the most useful gathering the Association has ever sponsored. No more accessible location than Chicago and the Stevens Hotel could have been found for these sessions that start on June 21st. Nothing but emergency will keep away from this 1942 meeting, *the water works man who feels his responsibility to his consumers* and wants to give them all the service they need for doing their part in this war.

HARRY E. JORDAN, *Secretary*  
*American Water Works Association*

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*It is an excellent way to serve your communities and your country.*

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## PUBLIC WORKS

"MORE THAN A WATER WORKS MAGAZINE"

## Disinfection Methods for Deep Wells

(Continued from page 21)

the chlorine solution has been added when you have fed enough outside water to displace the entire volume of the well. This method will carry the chlorine to the bottom of the well and out into the voids of the water bearing strata as desired. Give contact time and pump out as in Method 1.

3. A quick and easy method, but one that does not insure chlorination to the bottom. If the well has a deep-well turbine pump, then merely fit the pump discharge pipe with a small petcock and connect it by a hose to the chlorine solution crock or can. Then shut off the pump and open the petcock and the back-flow to the well will draw the chlorine solution down to the pump suction level at least. This method is applicable where the contamination came from the flooding of the well through an annular opening.

**Sealing Wells.**—I have had occasion to order many annular openings sealed. The simplest safe type of seal I have recommended is as follows:

Secure some heavy-gage wire or heavy sheet metal straps and make two so-called suspenders, such that they will hang down about 3 inches into the well casing. Then cut a piece of tin or hardware cloth of the diameter of the outside of the casing with a hole in its center the same size as the suction pipe or turbine discharge pipe. Then lay this down on the straps that have been placed one on each side of the suction pipe. Cover the tin or hardware cloth with tar paper and fill this 4"-deep section with hot tar, which will set up tight around the suction pipe and adhere to the

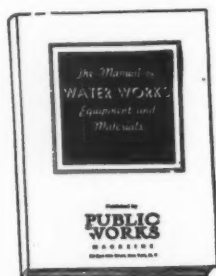
well casing. The advantage of this seal is that it is easily installed and easily removed.

## Reducing Cost of Leaf Removal

Until 1937, removal of leaves from the streets of Montclair, N. J., by the Dept. of Public Works cost about \$10,000 a year. During the next four years the Department reduced this cost 87% by use of improved methods and equipment and in spite of increased wages. In 1937, employees of the Department devised a motorized broom for pushing leaves into large piles, cutting the cost in two. In 1940 engineers of the Department, cooperating experimentally with manufacturers of the "Snogo," used this machine for loading the piled leaves into trucks, again more than cutting the cost in two. During the summer of 1941 complete leaf removal plans were developed and the men instructed in them, and about 200 refuse truck loads of leaves were removed from the streets between Nov 5 and Dec. 5 at a cost of \$1,326, as compared to \$2,134 in 1940.

The snow loader sucks the leaves from the piles and blows them into the truck, requiring only a driver on the loader, driver on the truck, and broom man on the street to sweep forward the few leaves that are left behind or blow out of the truck. The blower operated at 2100 rpm (100 above normal) on dry leaves, but when these were soaked by rain had to be speeded up to 2400.

The Public Works Dept. engineers believe that the 1941 cost is close to the minimum until there are unforeseen developments in machinery for doing the work. Walter Scholla was assistant to the town engineer in charge of this work.



## THE MANUAL OF WATER WORKS EQUIPMENT AND MATERIALS

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**THE** Manual of Water Works Equipment and Materials, published annually by PUBLIC WORKS, has established itself as a time saving and dependable guide for selecting equipment and materials by water works engineers and superintendents. Many of these have asked us to keep their names permanently on our mailing list, saying that they find the Manual exceedingly valuable in their work. The information given in text books is necessarily from one to five or more years old; that given in the Manual is less than a month old at the time of mailing. In fact, several devices and materials described were so new that no catalogs of them were available when the Manual went to press.

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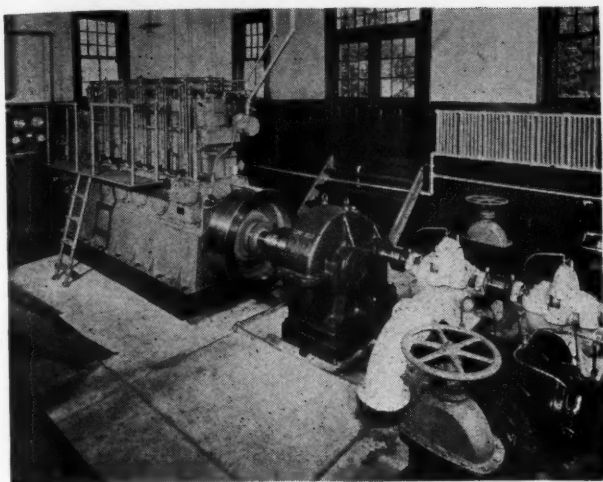
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Interior of Manhasset-Lakeville, New York waterworks plant.

### Coatings for Steel Water Pipes

The Asphalt Institute has completed a research program aimed at the development of a specification for an asphalt enamel which can be relied upon to fulfill all requirements for protecting steel pipe and yet can be produced by any well-equipped refinery. Specifications now have been adopted which describe asphaltic materials suitable for priming and for the enamel protective coating; how to apply the primer by either brushing or dipping; and for applying the enamel inside by spinning and outside by alternate coatings of enamel and asphalt-saturated asbestos; and finally for testing the efficacy of the completed coating.

The investigations showed that corrosion required the presence on the steel of both moisture and oxidizing agents, and that asphalt enamels are much less permeable to oxidizing agents than to water. Where corrosive agents have reached a pipe, it has been through openings in the coating due to improper application, to cracking of the enamel or its peeling or slipping from the pipe, or penetration of hard objects.<sup>E5</sup>

### Increasing Underground Storage

Santa Ynez river, in California, has a drainage basin of 900 sq. mi., and an annual run-off between 46,000 and 349,000 acre-feet. Land in the valley near its mouth is underlaid with sands and gravels that are replenished by each flood and furnish a source of water supply. To increase the supply thus available and to prevent the intrusion of salt water from the ocean into which the river discharges, an impervious barrier has been built across the river channel about a mile from the ocean. Here a sub-surface blanket of clay crosses the river basin where it is only 3,000 ft. wide. In the channel section a low fill was placed and two rows of Wakefield timber piling 15 ft. apart and about 30 ft. long were driven well into the clay. These were covered and tied together with a concrete slab which serves as a spillway. Dikes act as wing walls at both ends of this. This was built primarily to insure water supply for Camp Cooke, but will be of permanent value. Cost about \$300,000.<sup>E6</sup>

### Chlorine And Bacteria

The most important factors affecting the efficiency of chlorine are organic matter, hydrogen ion concentration, temperature, chlorine concentration and turbidity. A complex reaction takes place when chlorine comes in contact with organic matter and the germicidal efficiency varies with the quantity and type of such matter. Increased alkalinity causes decreased germicidal activity; this activity has been found to be greater in calcium-free water when calcium hypochlorite is used than when sodium hypochlorite or chlorine gas. Temperature does not readily influence the germicidal efficiency of hypochlorites except in

# The Waterworks Digest

Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.

destruction of acid-fast organisms; chloramine activity is more sensitive to temperature.

The exact concentration that is most effective must be determined for each plant, for which break-point chlorination is useful.

Chlorination is not a complete substitute for coagulation and filtration.

As the virus of poliomyelitis has been isolated from sewage, more must be learned about its resistance to chlorine although there is no epidemiological evidence that water is responsible for the disease.<sup>A47</sup>

### New Method of Breakpoint Control

At the Frankenmuth, Mich. plant, capacity 400,000 gpd, chlorine requirements range from 6 ppm. to 36 ppm. and water quality changes rapidly and quick determination of breakpoint is necessary. Effluents from the coagulation basin are filtered and titrated with N/50 sulfuric acid, using methyl orange-xylene cyanole indicator, the working solution being prepared by adding 10% of this to methyl orange. The color of the sample fades rapidly when the residuals are of breakpoint proportions. If the color fades within 15 min. after titration the residual is invariably from 0.8 to 1.1 ppm.; at 1.5 ppm. beyond the breakpoint the fading is almost instantaneous. So in 15 min. it can be learned whether the chlorine rate is too high or too low, while methods previously used required 4 or 5 hr.<sup>F28</sup>

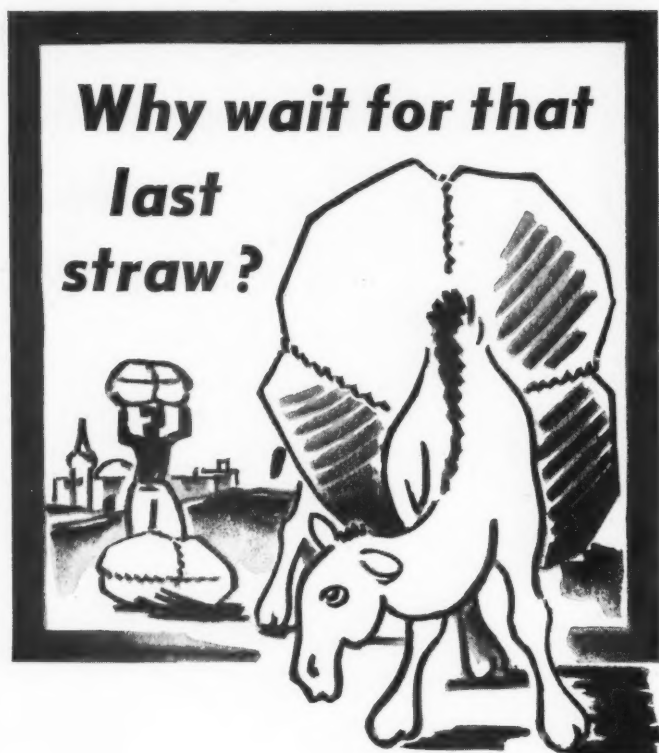
### Conditioning By Flocculation

The author believes that the coagulant should be applied in as dilute a form as possible and mixed rapidly with the raw water, tapered mixing producing the best results. Short-circuiting in the tank should be reduced to a minimum, and the tank should be subdivided into compartments, providing increased time in each succeeding one. Flocculators should have narrow paddle blades, arranged to cover a large percentage of area agitated by the paddle wheel, which area should be not less than 65% of the cross-sectional area of the basin. Changes of rate of agitation in any zone should be possible by changes in the arrangement or the number of paddles used. Variable-speed drive is desirable, to permit varying paddle speed with the changing conditions of the raw water.<sup>A54</sup>

### State Mutual Aid

A New York State Mutual Aid Committee has formulated a plan to prepare the municipalities of the State to maintain adequate, effective and safe water service under any possible emergency that may arise. Among the features is interconnections between public water supplies and approved supplies of industries and those of other communities. There are 100 such interconnections already and at least 200 others possible. Another is cooperation be-





**T**HINGS are moving fast these days. Municipal facilities that have been adequate for years are suddenly taxed to the limit. New burdens have been added — new demands for service — increased production. And it's none too soon to be anticipating the demands of tomorrow.

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tween water and fire departments, including a survey of all possible sources of water for fire fighting and of equipment for utilizing it; training regular water employees in emergency duties, organizing and training reserve crews for water department duties. A primary purpose is assistance of one community by others by interchange of materials, equipment and personnel, for which purpose the committee has made an inventory of all these available in each of the State's communities; this giving in detail the number and size of hydrants, valves, pipe, specials, portable pumps, chlorinators, machines for tapping, cutting, thawing, etc. At least 16 other states have adopted similar plans.<sup>A38</sup>

#### **Maintaining Centrifugal Pumps**

The most important equipment for maintaining centrifugal pumps includes welding equipment, lathes, shaper, drill press, power hack-saw, flame cutting equipment, micrometers, portable grinders and drillers, tool post grinder, stationary grinders, forcing press, metal spraying equipment, sand blasting equipment, arbor press, pneumatic chippers, coupling pullers. Also a well stocked store and tool room.<sup>A39</sup>

#### **Ammonia-Induced Break-Point Chlorination**

Engineers of the Houston, Tex., Water Dept. have developed a method of treatment in which an artificial break-point is induced by the addition of ammonia to dechlorinate the high residuals and to destroy the chlorine by-product tastes and odors resulting from super-chlorination. By partial dechlorination with the ammonia-induced break-point, high concentrations of residual chlorine can be maintained throughout the system. Experiment and operation indicate that this induced break-point always occurs at a ratio of 1 part of ammonia to 6.25 parts of chlorine. At this ratio, complete dechlorination and complete oxidation of the ammonia occur, and any excess of chlorine above that necessary for such oxidation yields a stable persistent free chlorine residual.<sup>A45</sup>

#### **Seismological Survey Of Underground Water**

A survey of the strata underlying Springfield, Mass., has revealed the presence of a water supply that could be tapped in an emergency. More than 900 borings were made, and a traveling seismological observatory was used to obtain, with errors of 2% or less, records of the depth of rock, dry and water-soaked sands. Blasts causing waves are produced from 1 lb. Nitramon charges, placed 12 ft. underground; and twelve small seismo-pickup stations, spaced along wires at 50 ft. intervals, are connected with the amplifying and recording apparatus.<sup>E9</sup>

#### **Filtration In Colombia**

Twenty years ago only a few cities in Colombia, South America, had good water supplies, and none were purified. Now there are more than a dozen filtration plants using rapid sand filters, most of them gravity but a few pressure. Alum, lime, soda ash and chlorine are used. Some have flocculators. Capacities of these plants range from 22.1 mgd for 380,000 population of Bogota to 2 mgd for Cartago's 15,000.<sup>M8</sup>

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*The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.*

c. Indicates construction article; n, note or short article; p, paper before a society (complete or abstract); t, technical article.

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  22. Bombing Danger to Tanks Shown by English Experience. By Eric Hardy. Pp. 183, 206.
  23. Automatic Station Control. By Glenn C. Boyer. Pp. 184-186.
  24. Relation of Copper and Brass Pipe to Health. By Frank E. Hale. Pp. 187-189, 207.
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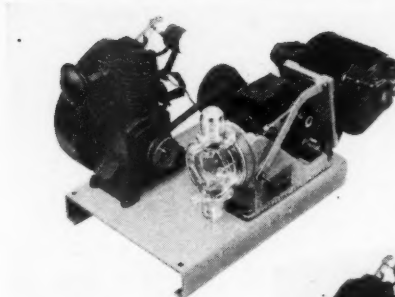


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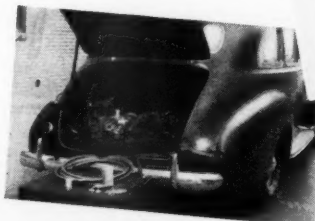


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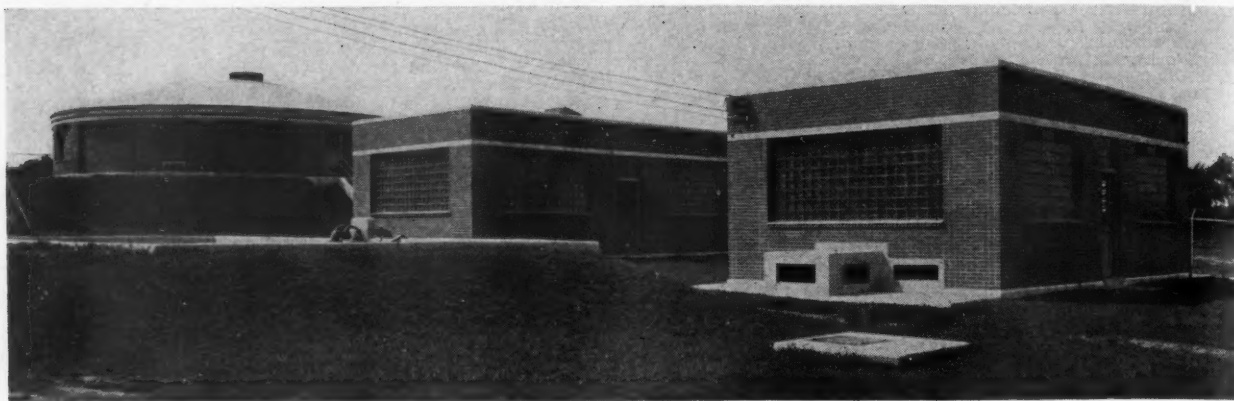
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General view of New Richland, Minnesota, sewage treatment plant.

## The Sewerage Digest

### Sphaerotilus Controlled With Chlorine

Mansfield, O., has had trouble with bulking in its activated sludge plant ever since it started in 1937. *Sphaerotilus* was found to be always present in the sewage. Use of more air did not remedy the trouble. But badly bulking sludge could be practically freed of the troublesome bacteria by reactivation for two days using 300 lb. of chlorine a day.<sup>H17</sup>

### Rates of Sewer Rental

The cost of operation and maintenance of the sewer system and treatment plant of Circleville, O., is carried by sewer rentals, set at \$6 per year per domestic user; for canneries, 10 cents for each 100 cases of No. 2 cans; for dairies, 1 cent per 1,000 lb. of raw milk or cream intake; meat processing, \$12 minimum. Cost of operation in 1940 was \$11,532, total collections, \$14,460. Of the cost, \$7,200 was for salaries and supervision.<sup>H17</sup>

### Designing Treatment Plants

Operation of treatment plants is facilitated by simplicity, flexibility and convenience. Even in large plants, complications are warranted only where they will increase efficiency or decrease operating costs. Illustrations of flexibility are provisions for varying rate of air application or of return sludge; non-mechanical units as standby's for mechanical ones; recirculation for high-rate trickling filters. More than anything else, an operator appreciates convenience of operation in all weathers and for making repairs; accessibility of valves and of all equipment for lubrication and repairs, and compactness of the plant as a whole.

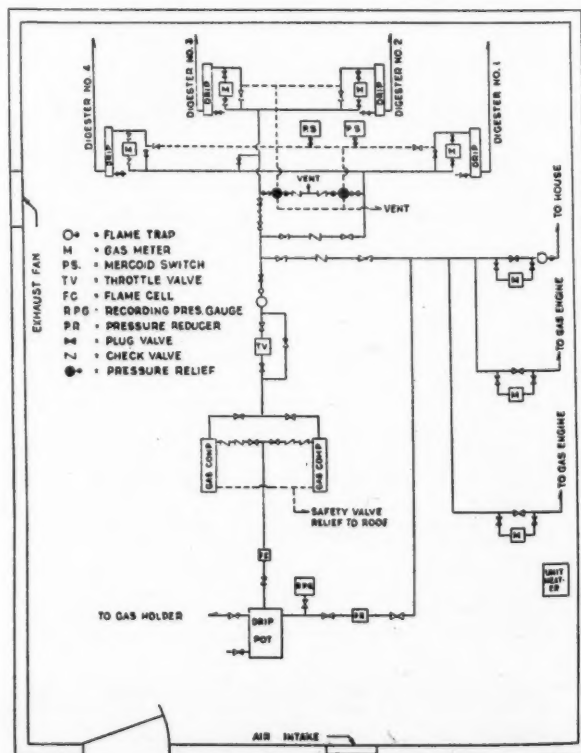
Handling of screenings, grit and skimmings is among the vexing of operating troubles. Curbs should be placed around sloppy equipment. Floors should be pitched to drains or sumps to facilitate washing down.<sup>C24</sup>

### Utilizing Sludge Gas

The Green Bay, Wis., plant, installed in 1934, used sludge gas under heating boilers. In 1937 two sludge gas engines and generators were installed, which produce almost all the power and hot water needed at the plant. The details have undergone several changes; as developed to date, all the boilers are run in series with the gas engines ahead of any radiators or unit heaters as they are aquastatically controlled and as the temperature of the digester coils is controlled by a thermostatic valve, and the cooling coil by a thermostatic valve which has its control

element in the gas engine water discharge line, the entire system is automatic.

All of the layout of the gas collection system is located in a room separated from the rest of the plant by solid brick walls, in which all the electrical equipment is explosion proof and ventilation is maintained by a motor-driven fan. The present layout is as shown in the illustration. Most of the units can be bypassed, and the gas can be bypassed directly into the distribution system. A pressure-operated regulating valve installed in the suction line of the compressors insures that the compressors operate at all times so long as there is 1 in. of pressure in the gas domes. The engines draw their gas supply directly from a Hortonsphere holding 175,000 cu. ft. of gas at 40 lb. pressure, which is exactly the right size for this plant, which produces an average of 54,000 cu. ft. of gas a day from 8,200,000 gal. of sewage, or 10.6 cu. ft. per lb. of volatile matter; which produces 760,000 kwh of power. All expenses, including interest and depreciation, leave a net profit of \$10,000 a year.<sup>C25</sup>



Courtesy Sewage Works Journal  
Layout of gas collection system at Green Bay, Wis.



### Gas Production At Gary, Indiana

Treatment in Gary's new plant began in August, 1940. Sludge is digested in 5 primary heated tanks and 3 secondary unheated ones provided with 60,000-cu. ft. floating gas holders. Pumping of raw sludge to primary tanks is controlled by the amount of gas required for power and other uses. If the holders are full, the waste gas is burned to prevent undesired pressure and blowing of seals. To prevent excessive accumulation of sludge it is sometimes necessary to pump to the secondary digesters. The secondary supernatant is not as strong as the raw sewage at some plants. Gas production is approximately 1.55 cu. ft. per capita per day—more than was anticipated.

A wire mill dumps 6,000 gal. of ferrous sulfate per week; when dumping occurs, clarification rises to 75%-89% from a normal of 25%-58%. On the other hand, waste oil from another industry dumped on two days a week apart caused gas production to drop from a normal of 136,600 cfd to approximately 80,000 for the following three weeks, and dissolved oxygen from 7 ppm to 0.6 ppm, and oil-coated sludge particles overflowed with the supernatant.<sup>C28</sup>

### Treatment Progress in 1941

Summarizing the literature published in 1941, the Committee on Research finds evidence of "the increasing importance of industrial waste treatment. . . . Brewery, distillery and yeast plant wastes, having very high potential pollution characteristics, have been under rather intensive study from various angles." Considerable progress has been made but the problem is not solved. Difficulties with metal wastes treatment seem to be increasing, calling in some instances for highly specialized and complicated methods of treatment.

Different systems of high-rate filtration have been rather extensively adopted for army cantonments, camps and posts. "It appears again that practice has outrun theory." However, interest in chemical treatment is still evident.

Sludge treatment and disposal whether by digestion, air drying, vacuum filtration, incineration or barging to sea, calls for further improvement with possible reduction in cost.

Greater concentration in all types of sludge treatment is receiving more attention. Use of tray clarifiers is of interest.

Progress has been made in methods of grease determination, but improved methods of analysis are needed. Progress has been made in connection with dissolved oxygen determination.<sup>C29</sup>

### Effect of Steel Mill Wastes

At Dunkirk, N. Y., due to war activities, from 6,500 to 8,000 gpd of pickling liquor reaches the Imhoff tanks, causing a sticky, dense sludge that will not settle through the slot but collects in the flowing-through chamber. The pH of the sludge drawn from the digestion chambers is around 4.0, and the sludge does not dry well. It is proposed to treat the liquor in two acid-proof tanks, used and rested alternately; collecting in one for 24 hrs., then neutralized with lime and standing for 24 hrs., then pumped to another tank from which it is discharged into the sewer at a constant rate throughout the 24 hrs.<sup>C32</sup>

### Equipment for Sewer Maintenance

The efficiency of a sewer maintenance crew is directly dependent on the amount and suitability of its equipment. A typical list of essential equipment carried by a full-time, large-city maintenance crew, working on all types of



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sewers, comprises: Major Equipment: A 2½-ton truck; power winch; manually operated winch; 1,000 ft. of flexible steel cable; 1,000 ft. of fire hose; 600-800 ft. of flexible rods (power drive desirable); 500 ft. of interlocking wood sewer rods; root cutters of assorted sizes; sewer brushes of assorted sizes; sand buckets, scoops and drags of assorted sizes; turbine flushing heads; steel sewer tapes and heavy wire (for small sewers); sewer flushing bags. Minor Equipment: Shovels, picks and mattocks; assorted wrenches; hydrant and manhole tools; flash lights (explosion proof); rubber boots, coats and gloves; buckets and rope. Safety Equipment: Hydrogen sulfide detector; carbon monoxide detector; combustible gas indicator; Wolf safety lamp; hose mask (double) with safety harness; safety belts (2 or 3); complete first aid kit; manhole guard rails; traffic signs and flags; oil lamps and flares.<sup>C34</sup>

### Treating Distillery Wastes

Still slop has a B.O.D. of 15,000 to 20,000 ppm, as compared to the 150 to 200 ppm of domestic sewage. The usual method of treatment is to screen through a 20- to 40-mesh screen and then evaporate in multiple-effect evaporators, mix with filtered grain particles that have been dried, and dry further to 10% moisture.

Still slop from rye whiskey is more difficult to treat than that from bourbon or mixtures, and was used in experiments to find the cheapest and most feasible method of removing the fine colloidal insolubles from the thin slop so that it could be evaporated more easily.

Experiments were made with filtration preceded by application of lime and sulfuric acid, calcium sulfate, calcium carbonate, phosphate fertilizer, activated alum, lime and phosphoric acid, and calcium dibasic phosphate. It was found that lime and sulfuric acid treatment cost least for a given filtration rate; lime moistened by air before slaking being less effective than dry lime; also if the heat of hydration occurs in the slop the filtration rate is reduced.

From an economic point of view, use of calcium dibasic phosphate is the best, since it alone retains its commercial value after use—in fact, its value is actually increased by the protein colloids removed by it from the slop. This removal varies from 15% to 36%, depending on the dose. The calcium dibasic phosphate treatment may be an economically feasible solution.<sup>C31</sup>

### Cost of Dragging Sewers

Ithaca, N. Y., drags at least one-third of its 67 miles of 6" to 36" sewers each year. The average cost per foot is 2 cents, which includes labor of dragging, cable, gas, oil, tires, maintenance of equipment, and making dragging brushes with idle labor in winter. The number of feet in which each of the several materials was the chief obstruction was as follows: Gravel, 75,809; roots, 42,504; grease, 36,145; cinders, 7,738; sand, 4,333; mud, 2,532; stone, 936; tile, 776; clay, 478; bricks (due to disintegration of manholes), 276.<sup>H16</sup>

### Sanitary Engineering A Distinct Profession

Historical accident rather than logic has associated modern sewage treatment with civil rather than with chemical engineering. Some of the subjects usually included in a college course in sanitary engineering are relatively useless. On the other hand, few curricula include such important subjects as microscopy and precise instruments, mechanical drawing, engineering statistics, fluid mechanics, ventilation engineering, air and gas analysis, industrial sanitation engineering, public health engineering, and a course in hydraulic models.<sup>H15</sup>

### Economy in Vacuum Filtration

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sludge, sludge digestion, vacuum filtration plant. At first ferric chloride was fed at a 5.1% rate (anhydrous basis) and hydrated lime at 8.7%. By changing from ferric chloride in the 60% crystal form at \$3.38 a cwt. anhyd. basis, to the liquid at \$1.70, \$650 a year was saved, partly offset by the \$2,700 cost of the necessary rubber-lined liquid storage tank. Instead of feeding the ferric chloride at strengths of 20% to 30%, as at first, it was diluted to 6% before making contact with the sludge, which permitted using less ferric and eliminated collection of it on the filter cloth.

By increasing the lime dose from a 10.7% rate to 14.1% the solids yield of the filter rose from 5 lb. per sq. ft. per hr. to 8.5 lb. or more; reducing the filter time for 50 tons of solids from 100 hours to 59 hours, giving a saving of \$56.40 in labor, truck hire and power, more than offsetting the \$17 additional cost for lime. But the high lime rate rotted the cloths, formed scale on the pump, and dust and ammonia fumes in the filter room. Elutriation eliminated these troubles by permitting reduction of the lime dose 50%; also the ferric chloride rate was reduced 30%, sludge was concentrated to 7.0% solids prior to filtration, and there was a saving of 75% in the time the chemical feeders were operated.<sup>114</sup>

### Bibliography of Sewerage Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; n, note or short article; p, paper before a society (complete or abstract); t, technical article.

- C** *Sewage Works Journal*  
March
24. Design of Sewage Treatment Plants to Facilitate Operation. By Stuart E. Coburn. Pp. 257-264.
  25. Utilization of Sludge Gas in Moderate Sized Treatment Plants. By George Martin. Pp. 265-274.
  26. Operation and Maintenance of Small Pumping Stations. By Grant M. Olewiler. Pp. 275-293.
  27. Sewage Disposal Problems at Army Camps. By Paul Hansen and K. V. Hill. Pp. 294-301.
  28. First Year of Operation of the Gary, Ind., Treatment Plant. By W. W. Mathews. Pp. 302-312.
  29. A Critical Review of the Literature of 1941 on Sewage

and Waste Treatment and Stream Pollution. By Committee on Research, Federation of Sewage Works Ass'ns. Pp. 317-367.

30. Grit Chamber Design. By Thomas R. Camp. Pp. 368-381.
31. Treatment of Distillery Wastes. By Abraham Wallach and Abel Wolman. Pp. 382-401.
32. Steel Mill Wastes and Their Effect on Dunkirk's Treatment Plant. By A. H. Woelfe. Pp. 402-403.
33. Investigations on Treatment and Disposal of Acid Industrial Wastes. By L. S. Morgan. Pp. 404-409.
34. Experiences in Sewer Maintenance. By W. H. Wisely. Pp. 410-427.
35. Handling Grit in Sewers. Discussion. Pp. 427-432.
36. Safety in Sewage Works. Discussion. Pp. 432-435.
37. What New York City Does About Screening Sewage. By Wellington Donaldson. Pp. 437-445.

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- February 13*
11. p. Sewage Disposal at Chigwell (England). By B. G. Kirk. Pp. 55-56.
- February 27*
12. Post-War Laboratory Planning and Equipment for Sewage Purification Works. By Reginald W. Covill. Pp. 75-76.
- E** *Engineering News-Record*  
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2. Good Practice in Sludge Disposal. By Willem Rudolfs. Pp. 52-55.
  3. How to Double Sewage Filter Capacity. P. 64.
- March 12*
4. Sewer Squad Organization for Air Raids. Pp. 113-114.
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7. Developments and Trends in Sewerage Practices of 1941. By Samuel A. Greeley and Paul Hansen. Pp. 51-64.
- H** *Sewage Works Engineering*  
March
14. Vacuum Filtration Problems at Marion, Ind. By David Backmeyer. Pp. 140-142.
  15. p. Sanitary Engineering—A Distinct Profession. By Arthur B. Morrill. Pp. 143-144.
  16. Chlorine as an Aid in Control of Bulking. By J. R. Turner. Pp. 145-147.
  17. Alum Precipitation of Sewage and Wastes at Circleville, O. By Ervin F. Leist. Pp. 152-154.
- J** *American City*  
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5. Sewage Treatment Plant of Quincy, Ill. Pp. 46-47.
- K** *Proceedings, Am. Soc. of Civil Engineers*  
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2. Hydrodynamics of Model Storm Sewer Inlets Applied to Design. By G. S. Tapley. Pp. 375-409.
- M** *Water and Sewage*  
February
5. Has the Use of the Activated Sludge System Been Justified? By A. E. Berry. Pp. 17-20.

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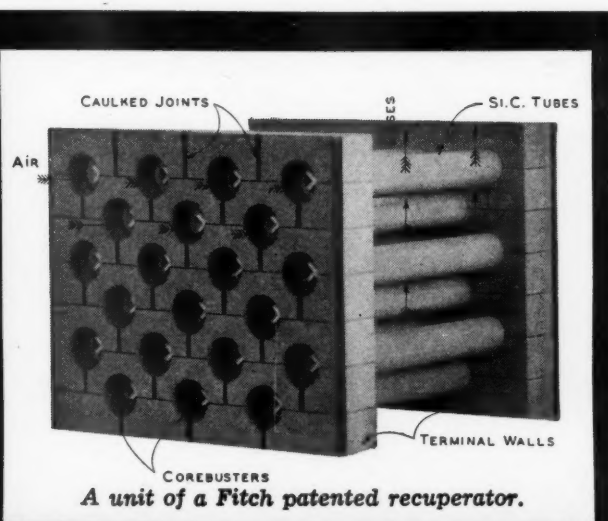
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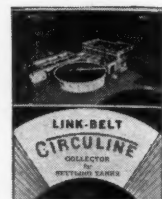
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The 11 x 17-inch compilation presents 48 detailed drawings selected by the Teco Engineering staff from the collection of several hundred designed in the course of practical work on actual timber engineering problems.

These typical plans cover 14 different types of timber design such as trussed rafters for housing projects, trusses for hangars, factories, and markets; grandstands, bridges and towers. Each group is introduced by a photograph of an actual structure in which that type of design was employed and an explanation of its use.

In the back of the book are "Handy Tables for Use in Timber Design," taken from the National Lumber Manufacturers Association publication, *Wood Structural Design Data*.

Loose-leaf binding permits any of the pages to be removed for more convenient use, and easy insertion in the proper places of additions which will be distributed from time to time.

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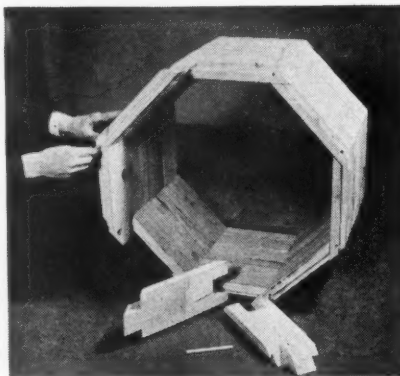
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## Wartime Drainage Pipe

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Middletown, Ohio.

How to build drainage structures without the use of any critical materials has been solved by the new Armco Emergency Pipe, recently invented.

Although it is still possible to get corrugated metal pipe for important locations on defense projects where no suitable substitutes can be found, such as airport runway drains under shallow cover and other locations of limited headroom or bad foundation conditions, there is a definite need for finding suitable substitutes for all other locations. To solve this problem, the Armco organization with 38 years of drainage



Armco Emergency Pipe.

and research experience set about to produce a wartime substitute.

The result was a wood structure—100 per cent of non-critical materials—requiring no steel bands, nails, nor metal reinforcing of any kind.

Wood has the advantage of being reasonably plentiful in most parts of the country; it can be designed for ample strength; it is sufficiently durable for the duration; it is light in weight, and it possesses further advantages.

Unlike the ordinary box-type of structure which is quite rigid, the opening of the Emergency Pipe is made up of a series of short stout segments, given an octagonal or other polygonal shape, connected together in an ingenious way to utilize the full strength of the material. Its construction has been likened to that of the Mormon Temple. The units are shop assembled or fabricated into lengths of 12 feet or more, which in turn are simply joined together in the field to make a single structure.

Strength tests show that the Emergency Pipe possesses many of the structural characteristics of corrugated metal pipe. It has flexibility which enables it to build up side support and increases its load carrying capacity. The thickness of the wood can be varied with the nominal diameter of the pipe.

Increased durability is obtained by

treating the wood with a non-critical material. It is intended to outlast the 5 to 10 year period for which most of the present army camps and cantonments are being built. On more permanent installations, replacement can readily be made either by threading corrugated metal through it or by jacking a metal pipe around it and removing the old structure.

A 4-page folder has been prepared illustrating and describing the features of the Emergency Pipe. Copies may be obtained from the Armco Drainage Products Association or any of its member companies.

## Screw Concrete Spreaders

Jaeger Machine Co.  
Columbus, Ohio

A new bulletin, describing the latest Model 10-14' and 20-25' Screw Spreaders for airport paving and military roads, has just been issued by the Jaeger Machine Company, Columbus, Ohio. Vacuum control for reversing the direction of spreading screw rotation by the movement of a valve is featured on half width models. Full width models, now in demand for military bases and airport slabs, are equipped with independently controlled right and left hand screw sections, eliminating the need for frequent reversals when spreading.

In addition to their ability to spread and strike-off today's skid mixes of as low as one-half inch slump concrete, at a rate exceeding the maximum production of 34E dual drum pavers, reports of Highway Engineers are submitted emphasizing the re-mixing and densifying effect of screw spreading and the absence of segregation, stone pockets, and honeycomb observed in screw spread materials. Contractors' reports on numerous jobs, showing production as high as 135 cu. yds. an hour in placing 25' slab and over 122 cu. yds. an hour in 12' slab, are included with the bulletin. On these record runs, the screw spreader was followed by the Jaeger-Lakewood Type H Finisher.

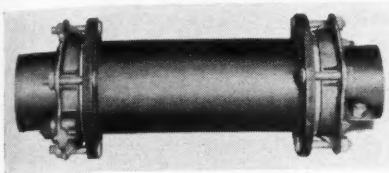
Reference is also made to the adaptability of the full width spreader to both spread and finish bituminous materials. On 40' re-surfacing pavement laid in half sections, two courses, in Cook County, Illinois, the Barberton Construction Company easily handled 150



Jaeger Screw Concrete Spreaders.



tons an hour on both base and top course of 1½" compacted thickness. The top was modified sheet asphalt.



Skinner-Seal Bomb Crater Clamp.

### Skinner-Seal Bomb Crater Clamp an Important Air Raid Precaution

*M. B. Skinner Co.  
South Bend, Ind.*

Gas and water companies in danger areas will be interested in a new device for quickly repairing mains where a gap has been blown out by the explosion. The new clamp, known as the Skinner-Seal Bomb Crater Clamp, makes a tight, lasting connection between the ends of the broken main and a random piece of steel pipe cut to appropriate length, to fill the space.

Developed by the M. B. Skinner Company, South Bend, Indiana, at the request of a prominent West Coast gas company, the new adapter makes use of standard Skinner-Seal Bell Joint Clamp parts to splice a proper length of steel pipe to fill in the gap in broken main, with minimum delay. Illustration shows how connection is made between main and steel pipe at each end of gap. Left end makes connection with main; right end makes connection with steel pipe. Note how flanges, welded to center tube, act as anchor rings for bolts.

Of interest, also, in connection with air raid precautions, the Skinner-Seal Split Coupling Clamp quickly repairs breaks in the main which are apt to occur for some distance on each side of the bomb crater.

According to The M. B. Skinner Company, they are in a position to make prompt deliveries to gas and water companies in probable air raid zones.

### Combined Sewer and Pipe Locator

*Frank N. Blake  
North Adams, Mass.*

The Blake sewer locator has now been fitted for finding metal pipes also, making one instrument do the work that formerly required two, and saving in first cost and subsequent operation.

For use in metal pipe finding the battery and other electrical parts, instead of being concentrated on the transmitter may be diverted to a lost pipe. Two reels of insulated copper wire aggregating several hundred feet in length have their inner ends always connected with battery and outer ones with spring clips for quick and reliable attachment to pipes without using pliers. After use the wires are rewound with a crank, avoiding danger of becoming tangled.

An amplifying receiving coil, phones

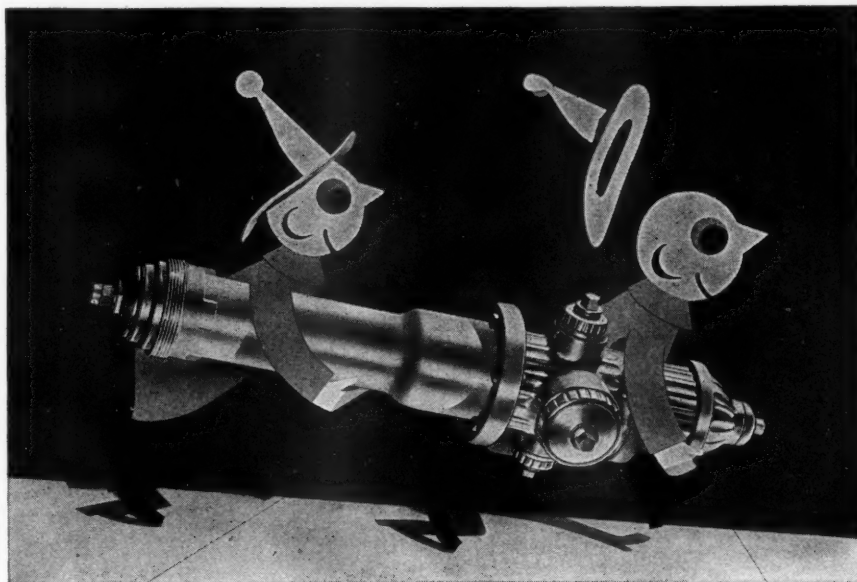
and all that is needed for locating both pipes and sewers except the steel snake, are contained in an 8½ x 12 x 12 inch case. Sewer rods are often used for pushing the transmitter into sewers though the 100-foot steel snake is more convenient.

### Pango Sewage Sampler

*Drake Manufacturing Company  
1461 Belfield Ave., Philadelphia, Pa.*

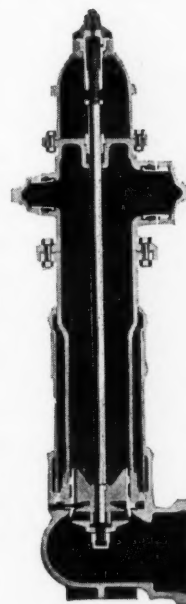
The manufacturers describe it as a steel chamber which is lowered into the tank by a sturdy, twin link chain, which

carries markings showing the various depths. The chamber is fitted with a valve mechanism operated by a cord. When the Pango Sampler reaches the desired depth, as indicated by the markers, a slight pull on the cord opens the valves and the liquid or sludge flows into the chamber through the bottom valve, while the air escapes through the top valve. At the lower levels the pressure variation actually forces the heavier sludge into the chamber. Releasing the valve cord closes the valves, which automatically seat themselves, sealing the chamber and contents, preventing a dilution while Sampler is withdrawn;



### "WE NEVER DIG— OUR HYDRANTS ARE MATHEWS"

Traffic smash? Check a drain valve? Street being lowered? General overhaul? You never order out the pick-and-shovel crew to service any Mathews Hydrant. Just unscrew the entire barrel from the elbow, lift it out through the loose protection case, and go to work. Replace it with a spare barrel if you wish. It's easy as changing a tire, for barrels are interchangeable and contain *all* working parts, including main and drain valve seats. Think of the labor savings! Think of the added fire protection! Think of Mathews Hydrants in these days of air raids.



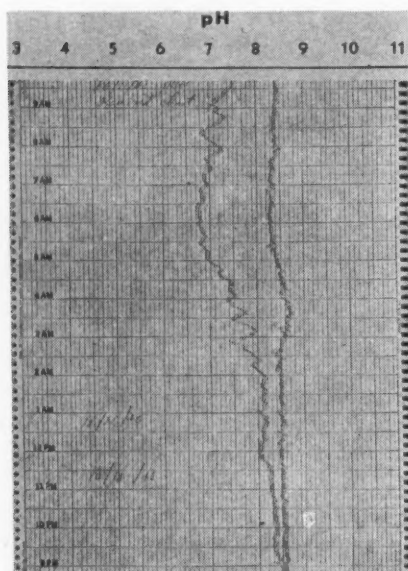
### MATHEWS HYDRANTS

*Made by R.D. WOOD Company*  
400 CHESTNUT STREET, PHILADELPHIA, PA.  
ESTABLISHED IN 1803

When you need special information—consult the classified READER'S SERVICE DEPT., pages 55-57

consequently the sample obtained is a true and accurate sample taken at the depth indicated. The contents are emptied where you want them, by a single pull on the valve cord; no messy pulling of corks or handling of makeshift rigging.

Write for folder giving more complete information on this new sampler.



Multi-Point pH Recorder Gives Single-Chart Record.

### Valuable Guide Continuously Shows pH at Separate Sampling Points

Cambridge Instrument Co.  
Grand Central Terminal  
New York, N. Y.

Now, simultaneous records of pH at separate and independent points in a fluid-flow system can be utilized to provide a continuous "before and after" picture of pH that enables the operator to continuously see the effectiveness of the process or treatment in use, and accordingly, guides him to attain best results.

The photograph shows an actual record from the condensate system of a large utility generating plant, where such guidance has helped to solve the important problem of turbine blade deposits. Already operating in central stations, this new development should prove of interest to engineers and executives in the process and other industries where far-reaching economies may be influenced by the pH at different stages in a process or treating operation.

Municipal water purification and treatment, and sewage disposal are also processes that require the maintenance of definite pH values at various stages to secure optimum results.

### Foster D. Snell, Inc., Expands Laboratory Facilities

Increasing laboratory space by more than fifty percent in the past year, Foster D. Snell, Inc., have added substantially to their facilities for rendering consulting and research services. Aside from additional unit laboratories, the

space is devoted to an enlarged constant-temperature room, additional photographic and photomicrographic equipment, another animal room which permits the handling of almost double the number of experimental animals, an enlarged library and additional facilities for handling sensitivity tests on human subjects.

### Mathieson to Produce Metallic Magnesium and Chlorine

In accordance with a contract which has been signed by the Defense Plants Corporation and The Mathieson Alkali Works, Inc., work on a new plant for the production of metallic magnesium and chlorine will be begun immediately, according to an announcement made by E. M. Allen, President of the Mathieson Organization.

The plant, which will be located at Lake Charles, La., and will cost approximately \$22,500,000, will be owned by the Defense Plants Corporation. It will be operated by Mathieson and will produce about 36,000,000 pounds of magnesium a year by a process developed by Mathieson.

This process differs from other processes for making magnesium electrolytically, in that it does not consume chlorine but produces it in such concentration that it can be collected and liquefied.

### New Advertising Manager

Chicago Pneumatic Tool Co.  
6 East 44th Street, New York, N. Y.

Joseph A. Sullivan, formerly Assistant Publicity Manager, has been made Advertising Manager. Due to the greatly widened scope of its activities, Chicago Pneumatic's Publicity Department was recently organized as the Sales Promotion and Advertising Department under the direction of Mr. Leslie S. Gillette, to whom Mr. Sullivan will report.

### Army Promotes Gilbert and Clark

Capt. J. J. Gilbert, Sanitary Corps, formerly Sanitary Engineer with the Link-Belt Co., has been promoted to the rank of Major. Lt. Lloyd K. Clark, Sanitary Corps, formerly State Sanitary Engineer of North Dakota, has been promoted to the rank of Captain. Both officers are on duty with the Subdivision of Sanitary Engineering, Office of The Surgeon General, U. S. Army.

### Conventions and Association Meetings

May 27 and 28. New England Sewage Works Assn. annual meeting at Hotel Bradford, Boston, Mass. LeRoy W. VanKleeck, Secty.

June 21-25. American Water Works Assn. annual meeting at Stevens Hotel, Chicago, Ill. Harry E. Jordan, Secty.

May 5-6. Annual Conference of Wisconsin Sewerage Works operators at Wassau, Wis.

### A.W.W.A. Elects Officers

The following officials have been elected by The American Water Works Association to take office at the close of the Annual Conference in Chicago on June 25th: Abel Wolman, President; Samuel Morris, Vice President; Wm. W. Brush, Treasurer.

### New Appointments

New City and County Officials recently reported:

#### City Engineers

Frederick A. Savage, Antioch, Calif.  
R. A. Klassen, Daly City, Calif.  
Seymour H. Phelan, Piedmont, Calif.  
C. H. Moneypenny, Daytona Beach, Fla.  
H. P. Edmond, Valdosta, Ga.  
W. S. Barackman, Eureka, Kan.  
Art. Rogers, Hiawatha, Kan.  
L. L. Stanley, Princeton, Ky.  
John P. Tawes, Crisfield, Md.  
Glen S. Weeks, Melrose, Mass.  
John C. Keefe, Northampton, Mass.  
W. J. Corbett, Menominee, Mich.  
Russell Carlson, St. Louis, Mich.  
Dewey Welch, Columbia, Mo.  
Thomas Henderson, Savannah, Mo.  
W. G. Robinson, Wahoo, Nebr.  
George Schilling, Sparks, Nev.  
Charles A. Pfeiffer, Gloversville, N. Y.  
George A. Reese, Kent (P. O. Canton), Ohio.

Brice Patrick, Muskegee, Okla.  
B. A. Nangle, Yankton, S. D.

#### City Managers

G. A. Shaw, Coral Gables, Fla.  
Allison B. Curry, Miami, Fla.  
Francis M. Hoag, Manchester, Iowa.  
Stephen R. Henderson, East Detroit, Mich.

John P. Hayden, Edmond, Okla.

#### Supt. of Public Works

H. R. Dean, Poughkeepsie, N. Y.

#### Water Works Superintendents

Clifford Fore, Carbondale, Ill.  
Enoch Gaddy, Olney, Ill.  
G. O. Weidenbach, Great Bend, Kan.  
D. P. Ayers, Hutchinson, Kan.  
Harold McConnell, Princeton, Ky.  
John J. Cahill, Malden, Mass.  
M. B. Oates, Watertown, Mass.  
Alan D. Drake, Buffalo, N. Y.  
A. E. Ransom, Canton, Ohio.

#### County Engineers

E. W. Wier, DeKalb Co., Decatur, Ga.  
Jack McIntyre, Greene Co., Bloomfield, Ind.  
Harry Hansel, Mahaska, Co., Oskaloosa, Iowa.  
C. J. Loreditch, Ellis Co., Hays, Kan.  
Forrest Porter, Wayne Co., Monticello, Ky.  
C. A. Hale, Calloway Co., Murray, Ky.  
H. E. Palmer, Dakota Co., Hastings, Minn.  
J. W. Haynes, Chickasaw Co., Houston, Miss.  
W. B. Amos, Douglas Co., Mansfield, Mo.  
C. R. Steele, Kingfisher Co., Kingfisher, Okla.  
Frank P. Graham, Mercer Co., Grove City, Pa.  
R. B. Kinney, Sauk Co., Baraboo, Wis.



# Readers' Service Department

These booklets are FREE but distribution is restricted to those actively engaged in engineering or construction. Use the coupon below or write the manufacturer direct, mentioning PUBLIC WORKS.

## Construction Materials and Equipment

### Air Raid Shelters

3. New 8 page booklet pictures and describes a corrugated pipe shelter with gas tight end walls, emergency escape tunnel and other desirable features. Armco Drainage Products Assn., Middletown, Ohio.

### Airport Lighting

A4. Handbook to help those who design airports to specify approved equipment and to facilitate planning all types of installations. Contents are C.A.A. typical air-lighting layout plans, recommended standards for airport lighting, airport lighting distribution equipment, typical wiring layouts and typical lighting layouts. Write Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

### Asphaltic Limestone

5. Characteristics, methods of laying, and results with cold lay mixture shipped ready to use. Especially adapted to resurfacing old pavements, sealcoats and airport runways. Alabama Asphaltic Limestone Co., Liberty Nat. Life Bldg., Birmingham, Ala.

### Bridges

A6. Tournapass is a portable, low-cost overpass, designed to eliminate traffic congestion at busy intersections. Photographs, actual time studies and car counts taken at a recent demonstration and trial period are featured in a new 4-page booklet. Also, transportation, assembly and construction are explained. For copies of this booklet write to R. G. LeTourneau, Inc., Peoria, Ill.

7. Teco Connectors, a new method of structural engineering, to spread the load on a timber joint more equally over the cross-section of the wood is described in new literature available from Timber Engineering Co., Inc., Dept. BS-2, 1337 Connecticut Ave., Washington, D. C.

8. A new booklet, "Highway Structures of Douglas Fir," gives up-to-date designs and illustrations of various types of Guard Rails, Culverts, Trestles, Truss Bridges, Arch Bridges and Suspension Bridges built with Douglas Fir. This helpful booklet sent on request by the West Coast Lumbermen's Association, 364 Stuart Bldg., Seattle, Wash.

### Cement Dispersion

9. "Economics of Cement Dispersion and Pozzolite" tells the complete story of how cement dispersion reduces water required up to 20% and increases workability 150%. Write The Master Builders Co., Cleveland, Ohio, for a copy.

### Cement, Early Strength

11. 64-page manual tells how to speed up year 'round concreting, shows how to secure high early strength and greater workability at temperatures either below or above freezing. Contains many actual examples of practical concreting operations; well illustrated with more than 60 photos, charts, graphs and tables. Calcium Chloride Assn., Penobscot Building, Detroit, Mich.

### Cold Mix Plants

15. New catalog and prices of Portable Bituminous Mixers in 6 to 14 ft. sizes for resurfacing and maintenance. Issued by The Jaeger Machine Co., 400 Dublin Ave., Columbus, Ohio.

### Concrete Accelerators

31. New 48-page booklet in five sections explains clearly the effects, advantages and methods of using Calcium Chloride and Portland Cement mixes. Complete and packed with practical information; well illustrated; pocket size. Sent free on request by Solvay Sales Corp., 40 Rector St., New York, N. Y.

33. Pocket manual of concrete curing with calcium chloride. Complete, handy. Contains useful tables, well illustrated. Write the Columbia Chemical Division, Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, N. Y. C.

### Concrete Mixers

44. Catalog and prices of Concrete Mixers, both Tilting and Non-Tilt types, from 3½ S to 56 S sizes. The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

### Concreting in Winter

47. "Build Straight Through the Cold Weather Season" explains briefly how to obtain satisfactory winter concrete in less time. Write Michigan Alkali Co., Ford Bldg., Detroit, Mich.

### Crushers, Stone

A50. "Cedarapids" line of stone crusher outfits, Models "SCO" include four sizes of jaw crushers, either plain or roller bearing, and may be used with either vibrating or revolving screen. New bulletin shows method of setting up the plant and shows drives, elevator, reject chute and compartment bin. Iowa Manufacturing Company, Cedar Rapids, Iowa.

A51. "You need a Big Primary to crush big rock" illustrates and describes the Cedarapids 25x40 Portable Jaw Crusher and Heavy Duty Steel Apron Rock Feeder that may be moved in and out of quarries and on the highway by a truck tractor. This specification sheet may be obtained by writing to the Iowa Manufacturing Co., Cedar Rapids, Iowa.

### Drainage Products

70. Standard corrugated pipe, perforated pipe and MULTI PLATE pipe and arches — for culverts, sewers, subdrains, cattlepasses and other uses are described in a 48-page catalog entitled "ARMCO Drainage Products," issued by the Armco Drainage Products Association, Middletown, Ohio, and its associated member companies. Ask for Catalog No. 12.

73. "Principles of Design of Airport Drainage" and other articles on airport drainage reprinted from PUBLIC WORKS Magazine are being distributed free by Bowerston Shale Co., Bowerston, O., Hancock Brick & Tile Co., Findlay, O., and Columbus Clay Mfg. Co., Blacklick, O. Address anyone of the above for a copy.

### Expansion Joints

84. Flexcell cellular expansion joints that compress without extruding and spring back when released are illustrated and described in a new bulletin prepared by The Celotex Corp., 919 No. Michigan Ave., Chicago, Ill.

A85. Serviced Products Corp., 6051 W. 65th St., Chicago, has just completed a new catalog of compiled facts on Expansion Joints and Water Seals. All of the different types of expansion joints are listed in this catalog. Copies upon request.

### Graders, Patrol

105. The Austin-Western 99M Power Grader with its powerful all wheel drive simplifies all construction and maintenance; handles difficult jobs with economy and efficiency; and does better work on grading, ditching, scarifying, snow plowing, loading, mixing, bulldozing, shoulder trenching and backsploping. Write for Bulletin 1946. Austin-Western Road Machinery Co., Aurora, Ill.

### Mud-Jack Method

107. How the Mud Jack Method for raising concrete curb, gutter, walls and street solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities — a new bulletin by Koehring Company, 3026 West Concordia Ave., Milwaukee, Wis.

### Paving Materials, Bituminous

111. New "Tarvia Manual" is packed with useful data on how to build and maintain roads with Tarvia. Each step is illustrated with excellent action pictures, 64 pp. 103 ills. Write to The Barrett Div., 40 Rector St., New York, N. Y.

114. Colprovia Paving Process for non-skid pavements include Plant Mixes by both the Heater and Cold Processes, Road Mix Process and Surface Treatment Process. New literature covering these processes is available from Colprovia Roads, Inc., 183 East Main St., Rochester, N. Y.

### Paving Materials, Brick

116. "New Developments in Brick Pavements." A review of the developments in brick pavements in recent years. Issued by the National Paving Brick Association, National Press Building, Washington, D. C.

### Pumps

120. Interesting new booklet tells how to lengthen the life of your pumps. Explains how a little care will save a lot of wear. Write today for your copy. Homelite Corp., 2403 Riverdale Ave., Portchester, N. Y.

121. New illustrated catalog and prices of Jaeger Sure Prime Pumps, 2" to 10" sizes, 7000 to 220,000 G.P.H. capacities, also Jetting, Caisson, Road Pumps, recently issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

123. New brochure by Gorman-Rupp Co., Mansfield, Ohio, illustrates and describes many of the pumps in their complete line. Covers heavy duty and standard duty self-priming centrifugals, jetting pumps, well point pumps, triplex road pumps and the lightweight pumps.

124. 16-page illustrated bulletin, SP-37, describes and illustrates complete C. H. & E. line of self-priming centrifugal pumps from ¼" to 8", including lightweight models for easy portability. C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee, Wis.

### Retaining Walls

126. Charts showing the design of cellular or bin-type metal retaining walls, helpful suggestions on their use for stabilizing slopes, preventing stream en-

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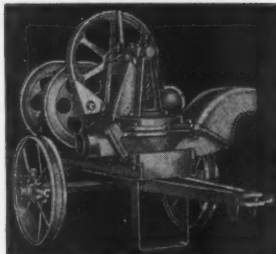
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**Milwaukee, Wis.**

## Readers' Service Department

(Continued from page 55)

croachment, and solving problems of limited right of way, and construction details are given in a 16-page bulletin entitled, "ARMCO Bin-Type Retaining Walls." It is published by the Armco Drainage Products Association, Middletown, Ohio, and member companies. Ask for Bulletin H-37.

### Road Building and Maintenance

128. Motor Patrol Graders for road maintenance, road widening and road building, a complete line offering choice of weight, power, final drive and special equipment to exactly fit the job. Action pictures and full details are in catalogs Nos. 253, 254 & 255, issued by Gallon Iron Works & Mfg. Co., Gallon, Ohio.

129. New bulletins illustrate and describe the latest line of Littleford Utility Spray Tanks, Street Marking Units, Street Flushers and Kettles. Littleford Bros., 453 East Pearl St., Cincinnati, Ohio.

### Rollers

133. New Tu-Ton roller of simple construction for use in rolling sidewalks along highways, playgrounds and other types of light rolling is fully described in a bulletin issued by C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee, Wis.

138. "The Buffalo-Springfield line of road rollers (tandem, 3-wheel, and 3-axle) are described in the latest catalog issued by the Buffalo-Springfield Roller Co., Springfield, Ohio."

139. "Ironeroller" 3 Axle Roller for extra smooth surfaces on all bituminous work. Booklet contains roller data and operation details. Hercules Co., Marion, Ohio.

### Shovels, Draglines, Crane

A141. The Link-Belt Speeder LS-60 heavy-duty 1/2-yd. crawler shovel, dragline, crane is covered by a new 8-page illustrated Book No. 1929. New simplicity, reserve power, easier handling, all welded construction, are features stressed. Illustrations show the machine at work and how it is built. Write Link-Belt Speeder Corp., 307 N. Michigan Ave., Chicago, Ill.

A142. "Shovel Output Begins with the Dipper," a little booklet "tells all" about the importance of dippers to shovel output and delivers all the facts about Bucyrus-Erie dippers. Plenty of pictures are included, showing both construction details

and performance. Copies may be obtained by writing to Publicity Department, Bucyrus-Erie Co., So. Milwaukee, Wis.

### Soil Stabilization

150. "High-Service, Low Cost Roads" is one of the newer booklets using an effective combination of picture and text to set forth the principals and advantages of road surface stabilization with calcium chloride. Complete, interesting and well illustrated. 34 pages. Sent by Solvay Sales Corp., 40 Rector St., New York, N. Y.

152. The Columbia Alkali Corporation, will be glad to furnish to anyone interested complete information dealing with Calcium Chloride Stabilized Roads. This literature contains many charts, tables and useful information and can be obtained by writing Columbia Alkali Div., Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, New York City.

154. "Soil Stabilization with Tarvia"—An illustrated booklet describing the steps in the stabilization of roadway soil with Tarvia will be mailed on request by The Barrett Div., 40 Rector St., New York, N. Y.

### Spreader

187. Jaeger Paving equipment, including Mix-in-Place Roadbuilders, Bituminous Pavers, Concrete Bituminous Finishers, Adjustable Spreaders, Forms, etc.—4 complete catalogs of latest equipment in one cover, issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

## Street and Paving Maintenance

### Asphalt Heaters

198. Illustrated Bulletins 15 to 20 describe Mohawk Oil Burning Torches; "Hot-stuff" Tar and Asphalt Heaters; Portable Trailer Tool Boxes; Pouring Pots and other equipment for street and highway maintenance, roofing, pipe coating, water proofing, etc. Mohawk Asphalt Heater Co., Frankfort, N. Y.

## Snow Fighting

### Snow Plows

A349. Booklet on snow removal, 8 pages in two colors, has just been released by the LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa. The booklet describes in detail the various models of snow plows manufactured for use with "Caterpillar" Diesel Tractors, and is filled with illustrations showing the equipment at work.

350. "Frink One-Way Sno-Plows" is a four page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1 1/2 up to 8 tons capacity. Interchangeable with V Sno-Plow. Features, specifications and method of attaching. Carl H. Frink, Mfr., Clayton, 1000 Islands, N. Y.

### Ice Control

351. "Make Icy Highways Safe for Traffic"—a new bulletin by Michigan Alkali Co., Ford Bldg., Detroit, Mich., tells how to use calcium chloride for modern ice control.

## Sanitary Engineering

### Activated Alum

354. "Technical Data on Activated Alum and Dustless Blackalum" points out the analytical side of Activated Alum and Blackalum. Write Stuart-Brumley Corp., 516 No. Charles St., Baltimore, Md.

### Aero-Filter

356. "Results Produced by Aero-Filters" is a new pamphlet covering results at Temple, Texas; Paris, Ill.; Webster City, Iowa; and Mason, Mich. Write Lake-side Engineering Corp., 222 West Adams St., Chicago, Ill.

### Air Release Valves

357. Automatic Air Release Valves for water, sewage and industrial uses are described and illustrated in new catalog issued by Simplex Valve & Meter Co., 6750 Upland St., Philadelphia, Pa.

### Analysis of Water

360. "Methods of Analyzing Water for Municipal and Industrial Use" is an excellent 94 page booklet with many useful tables and formulas. Sent on request by Solvay Sales Corp., 40 Rector St., New York, N. Y.

## Activation and Aeration

376. A valuable booklet on porous diffuser plates and tubes for sewage treatment plants. Covers permeability, porosity, pore size and pressure loss data, with curves. Also information on installations, with sketches and pictures, specifications, methods of cleaning and studies in permeability. 20pp. illustrated. Sent on request to Norton Company, Worcester, Mass.

## Chlorinators, Portable

380. Complete data on new portable chlorinator designed to meet emergency calls quickly and efficiently. Write Wallace & Tiernan Co., Inc., Newark, N. J.

381. "Emergency Sterilization Equipment," a new bulletin describing the advantages of Dual Drive Chlor-O-Feeders which can serve as either a permanent chemical feeder or as a portable emergency chlorinator. Order from Proportioners, Inc., 96 Coddington St., Providence, R. I.

## Cleaning Sewers

383. A 20-page booklet describes and illustrates a full line of sewer cleaning equipment—Rods, Root Cutters, Buckets, Nozzles and Flushers. Write W. H. Stewart (Pioneer Mfr. since 1901), Jacksonville, Fla., or P. O. Box 767, Syracuse, N. Y.

384. A new 32-page, illustrated booklet explains how a city can clean its sewers and culverts with its own forces using the up-to-date Flexible Sewer Rod equipment. Illustrates and describes all necessary equipment. Issued by Flexible Sewer Rod Equipment Co., 9059 Venice Boul., Los Angeles, Calif.

## Consulting Engineers

385. "Who, What, Why" outlines briefly the functions of the consulting chemist and chemical engineer. Covers various methods of cooperation, on different types of problems, with industry, with attorneys and with individuals. Foster D. Snell, Inc., 305 Washington St., Brooklyn, N. Y., will send a copy on request.

## Feeders, Chlorine, Amonia and Chemical

387. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sanitation treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from % Proportioners, Inc. % 96 Coddington St., Providence, R. I.

## Filter Bed Agitator

388. 60-page booklet, "The Mechanics of Filter Bed Agitation," containing engineering data, technical information concerning surface wash and opinions of users will be sent promptly by Stuart-Brumley Corp., 516 No. Charles St., Baltimore, Md.

## Fire Hydrants

390. Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M. & H. Valve & Fittings Co., Anniston, Ala.

391. See listing No. 410.

## Flow Meters

393. The primary devices for flow measurement—the orifice, the pilot tube, the venturi meter and others — and the application to them of the Simplex meter are described in a useful 24-page booklet (42A). Simplex Valve and Meter Co., 6750 Upland St., Philadelphia, Pa.

## Gates, Valves, Hydrants

394. Gate, flap and check valves; floor stands and fittings. New catalog No. 34 gives detail information with dimensions for all types of new full line. M. & H. Valve & Fittings Co., Anniston, Ala.

395. Complete booklet with much worthwhile water works data describes fully Ludlow hydrants and valves. Sent on request. Ludlow Valve Mfg. Co., Troy, N. Y.

396. See listing No. 410.

## Gauges

398. The full line of Simplex gauges for filtration plants are illustrated and described in catalog issued by Simplex Valve and Meter Co., 6750 Upland St., Philadelphia, Pa.

## Laboratory Apparatus

A401. In this elaborate and costly catalog all types of laboratory equipment are described and listed and a four-way indexing arrangement makes it easy for you to find the item you are seeking. All laboratories should have a copy of this catalog. If a copy has not been received, write for a copy. Phipps & Bird, Inc., Richmond, Va.

**Manhole Covers and Inlets**

402. Street, sewer and water castings in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., Lafayette Boul. and Indiana Ave., South Bend, Ind.

**Meters, Venturi**

406. New bulletin illustrates Builders Air Relay system of transmission for the Venturi Meter which is particularly useful for liquids containing suspended solids like sewage. Eliminates corrosion, clogged pipes, etc. Write Builders-Providence, Inc., Coddling St., Providence, R. I.

**Pipe, Cast Iron**

408. Handbook of Universal Cast Iron Pipe and Fittings, pocket size, 104 pages, illustrated, including 14 pages of useful reference tables and data. Sent by The Central Foundry Co., 386 Fourth Ave., New York, N. Y.

409. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Burlington, N. J.

410. "Cast Iron Pipe and Fittings" is a well illustrated 44 page catalog giving full specifications for their complete line of Sand Spun Centrifugal Pipe, Fire Hydrants, Gate Valves, Special Castings, etc. Will be sent promptly by R. D. Wood Co., 400 Chestnut St., Philadelphia, Pa.

**Pipe Forms**

411. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

**Pipe Repair Materials**

413. Repair clamps and saddles for steel and cast iron pipe; pipe line clamps; pipe joint clamps and many other handy and economical tools for the water works man. Catalog 41. M. B. Skinner Company, South Bend, Ind.

**Pipe, Transite**

414. Two new illustrated booklets, "Transite Pressure Pipe" and "Transite Sewer Pipe" deal with methods of cutting costs of installation and maintenance of pipe lines and summarize advantages resulting from use of Transite pipes. Sent promptly by Johns-Manville Corp., 22 East 40th St., New York, N. Y.

**Pipe Joints, Sewer**

415. How to make a perfect sewer pipe joint—tight, prevents roots entering sewer, keeps lengths perfectly aligned; can be laid with water in trench or pipe. General instructions issued by L. A. Weston, Adams, Mass.

**Pumps and Well Water Systems**

420. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for descriptive booklets. Advertising Dept., Layne & Bowler, Inc., Box 186, Hollywood Station, Memphis, Tenn.

**Meter Setting and Testing**

430. The most complete catalog we have seen on setting and testing equipment for water meters—exquisitely printed and illustrated 48-page booklet you should have a copy of. Ask Ford Meter Box Co., Wabash, Ind.

**Reservoirs, Concrete**

431. Data on how large reservoirs may be built at a saving as units by the Wm. S. Hewett System of reinforced concrete construction will be sent without obligation. The Wm. S. Hewett System, 20 N. Wacker Dr., Chicago, Ill.

434. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straightline Bar Screens" (Vertical and Inclined types). Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill.

**Sewers**

437. "ARMCO Sewers" is the title of a 48-page booklet describing the structural and other advantages of ARMCO

Ingot Iron. Paved Invert and Asbestos-Bonded pipe for storm and sanitary sewers. Design data and large charts will be found helpful by engineers engaged in the design or construction of sewers. Copies will be sent on request by the Armco Drainage Products Association, Middletown, Ohio, or its associated member companies.

**Sewer Pipe, Clay**

A438. Complete information covering use, purpose and shipment of vitrified clay sewer pipe and kindred vitrified clay products. Includes dimensions, schedules for extra strength vitrified clay sewer pipe intended for use in locations where intense loading problems are encountered. Write the Clay Sewer Pipe Association, Inc., Pittsburgh, Pa.

**Sludge Drying and Incineration**

440. "Disposal of Municipal Refuse." Complete specifications and description including suggested form of proposal; form of guarantees; statements and approval sheet for comparing bids with diagrammatic outline of various plant designs. 48 pages. Address: Morse Boulger Destructor Co., 216-P East 45th St., New York, N. Y.

442. Recuperator tubes made from Silicon Carbide and "Fireclay" Corebustors for maximum efficiency are described and illustrated in bulletin No. 11 issued by Fitch Recuperator Co., Plainfield National Bank Bldg., Plainfield, N. J.

443. Nichols Herreshoff incinerator for complete disposal of sewage solids and industrial wastes—a new booklet illustrates and explains how this Nichols incinerator works. Pictures recent installations. Write Nichols Engineering and Research Corp., 60 Wall Tower, New York, N. Y.

**Softening**

444. This folder explains the process of Zeolite water softening and describes and illustrates the full line of equipment for that purpose made by the Graver Tank & Mfg. Co., 4809-15 Tod Ave., East Chicago, Ind. Write for a copy of this instructive folder.

**Sprinkling Filters**

445. Design data on sprinkling filters of Separate Nozzle Field and Common Nozzle Field design as well as complete data on single and twin dosing tanks, and the various siphons used in them, for apportioning sewage to nozzles. Many time-saving charts and tables. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill.

**Swimming Pools**

446. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

**Taste and Odor Control**

450. Technical pub. No. 207 issued by Wallace & Tiernan Co., Inc., Newark, N. J., describes in detail taste and odor control of water with BREAK-POINT Chlorination, a method of discovering the point at which many causes of taste may

be removed by chlorination with little or no increase in residual chlorine. Sent free to any operator requesting it.

**Treatment**

453. "Safe Sanitation for a Nation," an interesting booklet containing thumbnail descriptions of the different pieces of P.F.T. equipment for sewage treatment. Includes photos of various installations and complete list of literature available from this company. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill.

455. New booklet (No. 1642 on Link-Belt Circuline Collectors for Settling Tanks contains excellent pictures; drawings of installations, sanitary engineering data and design details. Link-Belt Company, 2045 W. Hunting Park Ave., Philadelphia.

456. New 16-page illustrated catalog No. 1742 on Straightline Collectors for the efficient, continuous removal of sludge from rectangular tanks at sewerage and water plants. Contains layout drawings, installation pictures, and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia, Pa.

457. New illustrated folder (1942) on Straightline apparatus for the removal and washing of grit and detritus from rectangular grit chambers. Address: Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.

458. "Sedimentation with Dorr Clarifiers" is a complete 36-page illustrated catalog with useful design data. Ask The Dorr Company, 570 Lexington Ave., New York, N. Y.

459. A combination mechanical clarifier and mechanical digester, The Dorr Clarigester, is explained and illustrated in a bulletin issued by The Dorr Company, 570 Lexington Ave., New York, N. Y.

461. Preflocculation without chemicals with the Dorrco Clariflocculator in a single structure is the subject of a new booklet issued by The Dorr Company, 570 Lexington Ave., New York, N. Y.

462. Dorrco Monorake for existing rectangular sedimentation tanks, open or closed, is described and illustrated in a new catalog sent on request. The Dorr Co., 570 Lexington Ave., New York, N. Y.

**Tunnel Liners**

480. "Save Money with Armco Light Duty Tunnel Liner" is a bulletin you'll want if you are interested in economical, long lasting tunnels. Write Armco Drainage Products Assn., Middletown, Ohio.

**Valves (See Gates, Air Release, etc.)****Water Works Operating Practices**

490. "Important Factors in Coagulation" is an excellent review with bibliography and outlines of latest work done in the field. Written by Burton W. Graham and sent free on request to Stuart-Brumley Corp., 516 No. Charles St., Baltimore, Md.

**Water Service Devices**

500. Data on anti-freeze outdoor drinking fountains, hydrants, street washers, etc., will be sent promptly on request to Murdock Mfg. & Supply Co., 426 Plum St., Cincinnati, Ohio.

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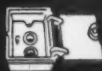
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## INDUSTRIAL MOVIES

In this column each month we shall review motion pictures that are available to our readers for showing to engineering groups. Unless otherwise stated films are available on two weeks notice and without charge.

### Base Stabilization With Tarvia

16mm, Kodachrome sound film, app. 1,200 ft., 30 minutes.

This film describes the laboratory procedure prior to the base stabilization job, the construction operations on the job, and a number of views of finished projects in different parts of the country. Available to groups east of the Mississippi River. Only requirement is that film be returned promptly with report of the number of persons seeing it. Address requests to Mr. Geo. E. Martin, Cons. Engr., The Barrett Division, 40 Rector St., New York, N. Y.

### From Mine to Consumer

16mm, Natural color and black and white, silent film, two reels, 30 minutes.

This educational picture shows how copper ore is mined, smelted and refined; the alloying of copper to make brass and the fabrication of copper and copper alloys in the form of sheets, wire, rods, tubes and special shapes. Suitable for non-technical as well as technical audiences, the picture portrays important operations of the copper and brass industry. Address inquiries to Mr. A. R. Stocking, Genl. Sales Dept., The American Brass Co., Waterbury, Conn.

### Asphalt: Nature's Most Versatile Product

16mm, Black and white, sound film, 800 ft., 22 minutes.

Starting back in the days of Babylon, this picture shows the various uses for asphalt through many centuries down to the present time. Of particular interest are refining methods and the use of asphalt in highway construction. Narrated by Alois Havrilla. To borrow this film write Mr. Ernest M. Bristol, Dir. Public Relations, The Asphalt Institute, 801 Second Ave., New York, N. Y.

### Behind the Water Tap

Described in March, page 53.

### Better Roads Ahead

16 mm, Kodachrome, sound film, 400 ft., 10 minutes.

This is the story of the origin, manufacture and technical control of Vinsol Resin which the manufacturers claim makes a new type cement when added at the clinker-grinding stage in cement mills . . . a cement that makes concrete more resistant to chemical de-icing agents, weathering, improves workability of concrete and speeds finishing operations. Write Mr. Geo. B. Bossert, Adv. Dept., Hercules Powder Co., Wilmington, Del.

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